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MISSOURI BOTANICAL GARDEN BULLETIN

VOLUME VIII

WITH 19 PLATES

1920

ST. LOUIS, MISSOURI

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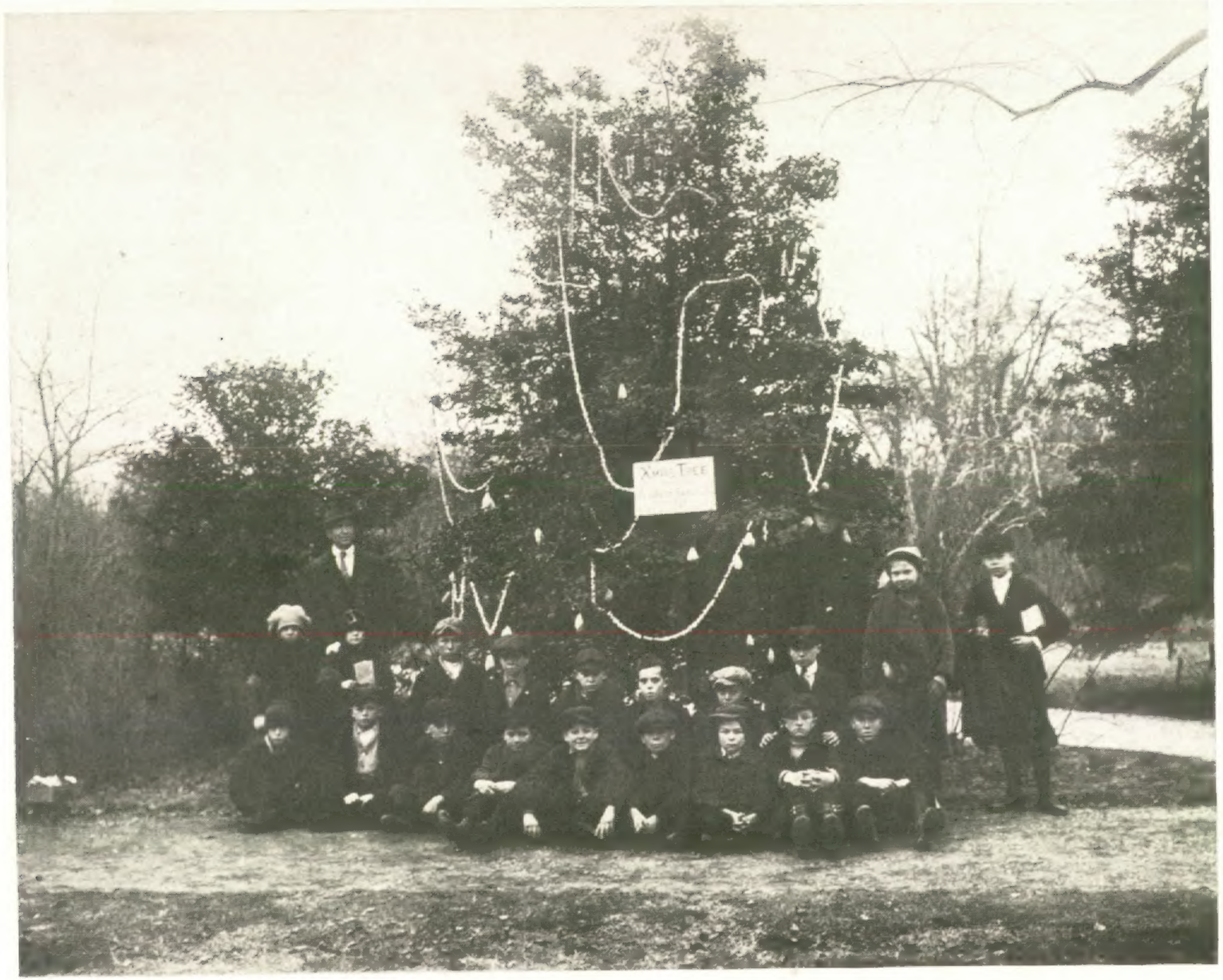

CHRISTMAS TREE FOR THE BIRDS OF SHAW'S GARDEN, FROM THE ST. LOUIS BIRD CLUB.

Missouri Botanical Garden Bulletin

Vol. VIII St. Louis, Mo., January, 1920 No. 1

THIRTY-FIRST ANNUAL REPORT OF THE DIRECTOR

Gentlemen:

I have the honor to submit herewith the thirty-first annual report of the Director.

For an institution like the Garden, with a relatively stationary income but with less money than usual available for Garden purposes during the past year, it is becoming increasingly difficult to maintain the various activities as they should be. During the war, because of the fuel restrictions, labor shortage, and scarcity of materials, there was a legitimate excuse and explanation for curtailing work, but the year 1919 has for various reasons been the most difficult from an administrative standpoint that the Garden has ever experienced. Many details which have very properly been neglected for the past three or four years had to be attended to, and the demands of the laboratories, library, and herbarium, as well as the general garden, which previously could be ignored, necessitated most careful consideration.

While the war was on it was, of course, impossible to keep up the additions to the library and herbarium as in normal times, and the number of graduate students naturally fell off considerably. The School for Gardening was closed and the indoor floral displays practically abandoned. These restrictions effected actual savings which helped to offset the increased cost of labor and such materials as could be obtained. With the war over, the public naturally expected the Garden to immediately come back to its former state of efficiency without perhaps realizing that in order to accomplish this a great deal more money would have to be available than had ever been needed before. Similar institutions in this country which are supported entirely or partially by private contributions or from money received from municipal or state funds, have been able to demonstrate without difficulty the necessity for receiving additional money for maintenance, and in most cases have secured enough to at least make it possible

to maintain their activities on the same basis as before the war. The resources of the Garden, which of course must be carefully husbanded and most conservatively managed, do not, at the present time at least, permit of a sudden expansion to meet such extraordinary conditions as are now being experienced. In fact, the increase in taxes and the administration of the estate, which, of course, must be taken care of first, have left the Garden with some thousands of dollars less available for direct Garden purposes than in the previous year. It is confidently expected that additional revenues may be available before it is too late, but in the meantime the most that can be hoped for is to maintain the various activities of the Garden and not to be compelled to abandon any of the various features—either scientific or popular—which have contributed to place the Missouri Botanical Garden in its present position.

Reconstruction of the Linnean House.—In 1882, Mr. Shaw built a plant house "dedicated to Linneus by placing his bust over the entrance." This house, the only one remaining of those built by the founder of the Garden, has been closed to visitors for several years, because of the unsafe condition of the roof. The location and exterior of the Linnean house made it too attractive to be abandoned, and consequently early in the year a new glass roof replacing the old slate and glass combination was supplied and the house put in thorough repair. This included an entirely new heating system, the elimination of the old walks, and the use of about 300 loads of earth in order to produce the landscape effect desired for the collection of evergreens, azaleas, rhododendrons, camellias, etc., which was to be established there. The central feature of this building is a pool and a rock ledge patterned after the familiar type to be found along the Meramec River, and an interesting natural curiosity, showing a tree overgrowing a huge stone, was made a part of this structure. There has thus been added to the Garden an interesting permanent collection of plants which, because of the natural arrangement provided, is displayed in an admirable manner.

New Propagating and Growing Houses.—The main range of growing houses back of the wall, constructed of wood some years ago, being no longer suitable for the propagation and maintenance of plants, was abandoned during the winter of 1918. Because of savings made from other accounts, it became possible this year to begin the construction of four greenhouses of a modern type 100 x 21 feet, with an additional propagating house 100 x 7 feet, designed especially for grow-

ing cuttings. Two of these houses have been completed, and the material for the remainder of the range is on hand, so that it will be finished within the near future. The Garden is therefore, for the first time, equipped with the proper type of greenhouses for the growing of the immense amount of material necessary for the planting of the various outdoor gardens as well as for maintaining the permanent stock used during the winter in the floral display house.

Additional Construction Work.—Another much-needed improvement was the completion of the concrete heating tunnel carrying the 6-inch main from the principal tunnel to the valve chamber controlling the growing houses. This tunnel, about 6 feet wide, 7 feet high, and 175 feet long, enables one to immediately reach all the heating pipes on the system and affords a considerable saving in heat over the old condition when the pipes were buried in the ground and there was no means of promptly repairing leaks.

Other additions include the new trellises for the rose garden, the construction of a brick walk through the pergola, a start towards the building of the walk from the pergola to the economic garden as well as putting in the foundation and necessary culverts for the walk back of the pergola through the projected wild flower garden, the repainting of the interior of the office building and Cleveland Avenue house, painting of the Director's residence, the old Shaw residence and the Linnean house, besides an unusual amount of general repair and painting work throughout the Garden.

Some New Features.—A new garden, known as the test garden, has been established just west of the office building. During the season of 1919 about 200 varieties of plants were grown here, with the idea of being able to show to those interested novelties and new varieties obtained through the catalogues of seedsmen and other sources. Aside from affording an opportunity for the public to judge of the merits of these plants, it furnishes a demonstration of the adaptability of the new forms to St. Louis conditions, and it is believed that a continuation of these tests will not only serve a useful purpose for the amateur, but will also enable the Garden to gradually select from the new varieties of flowering plants some which may be used to advantage in its own plantations.

A start has also been made towards another outdoor garden long contemplated, namely, the wild flower collection back of the pergola. The natural conditions here are admirably suited for growing native wild flowers, and during the

past season about 75 varieties, comprising over 4000 plants, have been established.

A variety nut orchard was established last fall. Some of the best varieties of pecans, black walnuts, Persian walnuts, and hickories have already been planted, and it is expected that an opportunity will be afforded to test systematically all varieties of native and imported nuts which are hardy in this region. In addition, there are being collected samples of all nuts that can be grown here and elsewhere, in order that definite information may be available at all times as to the nature of the products from various trees and their value for commercial purposes.

Very considerable additions have been made to the iris collection and the hardy perennials on the knolls. The pools in front of the Linnean house, formerly devoted to waterlilies, are now stocked with all the best varieties of lotus.

The difficulties of growing evergreens out of doors at the Garden has made it highly desirable that a collection of these plants be established under glass, and with the remodeling of the Linnean house it for the first time became possible. There have accordingly been established here about 130 species of conifers, together with some of the more rare rhododendrons, azaleas, ericas, and other members of the heath family.

The southern half of the greenhouse leading from the banana pit (formerly known as the varied industries house) has been replanted and is now devoted to a collection of tropical fruits. It is hoped that within a few years the trees will become sufficiently well established to afford an opportunity for the visitor to view these unusual and interesting plants in both fruit and flower. Many of the standard commercial varieties of orange, lemon, lime, pummelo, kumquat, and other citrus plants are to be found here, and in addition some of the more recently introduced fruits, such as the litchi, avocado, jujube, pineapple guava, etc., are being established.

Aquaria and Collection of Fish.—The alcoves of the aroid house, formerly devoted to the exhibition of orchids, have been adapted for a display of fancy fish. Some 35 aquaria, with an appropriate setting, have been established here, and, through the coöperation of the St. Louis Aquarium Society, a most interesting lot of fish—mostly tropical—are now on display. An opportunity is likewise afforded of including practically all of the aquatic plants suitable for aquaria, and

there are now to be found here about 30 varieties of plants, growing either completely or partially submerged, such as it is not ordinarily possible to show in a garden.

Indoor Floral Displays.—The removal of the fuel and other restrictions incident to the war made it possible to resume the indoor floral displays in November, at which time there was staged an attractive chrysanthemum show. This was followed by the usual Christmas display of poinsettias, peppers, narcissi, etc. An innovation this year was the extensive use of the pink and white poinsettias, and for the first time the orchids were grouped in the floral display house. The orchid show, which will now be an annual feature, will enable the Garden to satisfactorily display the extraordinarily large number of these plants which, since the acquisition of Mr. D. S. Brown's orchids, excels any other collection in the country.

School for Gardening.— In October the School for Gardening, which, because of the war, had been closed for over a year and a half, was reopened. Mr. Alexander Lurie, Horticulturist to the Garden, having resigned to go into commercial work, the school was temporarily placed in charge of Mr. G. H. Pring, formerly Floriculturist to the Garden, but whose title has been changed to that of Horticulturist. Mr. L. P. Jensen, for a number of years in charge of the grounds of the Busch estate, has been added to the instructional force and will in addition have charge of the trees and shrubs at the Garden under the title of Arboriculturist. Mr. Paul A. Kohl, graduate of the School for Gardening in 1917, and who, except for the time absent in France, has been associated with the School Garden work of the Board of Education, becomes Floriculturist to the Garden on January 1, 1920, and will likewise give instruction in the school. It is anticipated that at least one addition to the staff will be made during the coming year. There are now the following holders of Garden scholarships in attendance at the school: Miss Virginia McMath, Mr. Robert Mitchell and Mr. James Monteith.

Vocational Training for Soldiers.—The Federal Board for Vocational Education of Disabled Soldiers, realizing that the Missouri Botanical Garden was one of the few places in the country where specialized instruction in plant propagation, general greenhouse work, principles of landscape gardening, etc., could be adequately given, has entered into an arrangement with the Garden whereby men under its supervision can receive both practical and theoretical training as gardeners.

As it was not possible to enter these men in the School for Gardening, an independent course has been planned, including simple landscape gardening, floriculture, elementary botany, tree surgery, soils, diseases of plants, and other fundamental subjects. In addition, the men give part of their time to practical work in the greenhouses and outside gardens, and it is believed that the training received will qualify them for positions on private estates as well as for park and cemetery work. It is also probable that some of these men will fit themselves for the florist's business or some other commercial line.

St. Louis Meeting of the American Association for the Advancement of Science.—During the last week in December the meetings of the American Association for the Advancement of Science were held in St. Louis. On December 31 the botanists and horticulturists in attendance visited the Garden, being conducted through the greenhouses and grounds and afterwards having luncheon served in the office building. The joint session of the societies was held in the lecture room in the afternoon. While not occurring in the year 1919, the Trustees' Banquet, held on January 2, 1920, should be mentioned at this time, since it was given in honor of the visiting members of the Association.

ATTENDANCE FOR THE YEAR 1919

	Week-days	Sundays
January	4,114	4,239
February	2,070	2,821
March	4,026	6,705
April	6,354	7,732
May	6,668	8,432
June	8,940	7,766
July	10,600	6,271
August	10,863	10,733
September	9,569	7,989
October	6,139	8,022
November	24,454	24,733
December	5,796	4,500
	99,593	99,943
	99,593	
Total		199,536

ANNUAL BEQUESTS

The Annual Flower Sermon, provided for in the will of Mr. Shaw, was preached at Christ Church Cathedral, on May 18, by the Rt. Rev. John A. Richardson, D.D., D.C.L., Bishop of Frederickton, New Brunswick, Canada.

RESEARCH AND INSTRUCTION

The number of courses of instruction primarily for graduate students offered during 1919-20 is a considerable increase over that of 1918-19, due chiefly to two causes, as follows: First, under war conditions it was desirable to make formal courses (involving lectures and laboratory work) secondary to the informal courses, the latter being concerned primarily with the direction of research. Secondly, inasmuch as new graduate students were registered both in 1918-19 and in 1919-20, it became necessary to extend to all the opportunities in the way of formal courses usually distributed over two years. The extent of the research work now in progress is perhaps greater than at any previous time.

In addition to the instructional work and research referred to above, some of the time of members of the scientific staff and the facilities of the laboratory have been utilized in the promotion of scientific work in collateral ways, some of which may be mentioned. The Director, Dr. George T. Moore, was appointed General Secretary of the American Association for the Advancement of Science and had charge of the arrangements for the meeting of this association and affiliated societies in St. Louis, December 29–January 1. At the same meetings Dr. B. M. Duggar served as the local representative of the Botanical Society of America, American Phytopathological Society, and the American Ecological Society. During the summer of 1919 Mr. R. W. Webb performed the duties of field assistant in the Office of Cereal Investigations, Bureau of Plant Industry, United States Department of Agriculture. Dr. Duggar spent the summer in research work at the Coastal Laboratory of the Carnegie Institution of Washington, located at Carmel, California. For a period of several months the facilities of the graduate laboratory were extended to several pathologists representing the Office of Cereal Investigations of the Bureau of Plant Industry while engaged in a study of a serious disease (known as foot rot) of wheat prevalent in the Illinois bottoms in the vicinity of East St. Louis.

Scientific and Popular Lectures.—The more important of the scientific and popular lectures given by members of the scientific and Garden staffs during 1919 are as follows:

B. M. Duggar, January 13, before the Washington University School of Medicine, "Hydrogen Ion Concentration and Bacterial Activity."

B. M. Duggar, February 7, before the Society of Sigma Xi, "Investigations of 'Ultramicroscopic' Organisms Inducing Plant Diseases."

B. M. Duggar, April 25, before the American Philosophical Society, at Philadelphia, Pennsylvania, "Hydrogen Ion Concentration of Nutrient Solutions in Relation to the Growth of Seed Plants."

B. M. Duggar, May 19, before the St. Louis Academy of Science, "Important Factors in the Constitution of Nutrient Solutions for the Growth of Seed Plants."

B. M. Duggar, June 5, before the Cereal Pathologists, "Disease Resistance in Plants: Immunity."

B. M. Duggar, June 11, before the Members' Conference of the Chamber of Commerce, "Why an Art-in-Industry Exhibition in St. Louis is Indispensable."

B. M. Duggar, June 18, before the Synapsis Club of the Graduate School of Subtropical Agriculture, Riverside, California, "Research Work at the Missouri Botanical Garden and Shaw School of Botany."

B. M. Duggar, June 21, before Pacific Section of the American Association for the Advancement of Science, Pasadena, California, "Salt Requirements and Hydrogen Ion Concentration in Solution Cultures for Seed Plants."

B. M. Duggar, September 18, before the Science Club of the Utah Agricultural College, Logan, Utah, "The Importance of an Emphasis upon Research under Existing Conditions."

Alexander Lurie, January 8, before Gardeners' Association of St. Louis, "Pruning."

Alexander Lurie, January 9, before the St. Louis Florists' Club, "Horticulture."

Alexander Lurie, March 21, before the Bryan-Mullanphy School, "Vegetable Gardening."

Alexander Lurie, April 18, before Rose Fanning School, "Gardening."

Alexander Lurie, April 21, before Pierre Laclede School, "Gardening."

George T. Moore, January 15, before the St. Louis Natural History Museum Association, "The Educational Value of the Missouri Botanical Garden."

George T. Moore, March 17, before the St. Louis Academy of Science, "Some Novel Uses for Sea Weeds during the War."

George T. Moore, May 3, before Artists' Guild, "Plants and People."

George T. Moore, November 7, before Science Section of Missouri Teachers' Association, "The Missouri Botanical Garden as an Educational Institution."

George H. Pring, April 9, before the West End Business Men's Association, "Beautification of St. Louis."

George H. Pring, May 8, before McKinley High School, "Horticulture as a Profession."

George H. Pring, May 8, before the St. Louis Florists' Club, "Plant Curiosities."

George H. Pring, November 5, before the St. Louis Association of Gardeners. "The Cultivation of the Cultivated Chrysanthemum."

Graduates, Fellows, and Investigators.—Inasmuch as the expansion of university work since the close of the war has been marked and the call for scientifically trained young men unusually strong, there have been, as might be expected, fewer applications for fellowships and graduate work than under pre-war conditions. Nevertheless, all fellowships and assistantships have been filled, and the work among candidates for degrees in the graduate laboratory is on a plane which indicates a return to pre-war conditions. There were registered for graduate work during the calendar year eleven students, as follows: G. M. Armstrong, Rufus J. Lackland research fellow; W. H. Chambers, Rufus J. Lackland research fellow; Adele Lewis Grant, teaching fellow, Washington University; Joanne L. Karrer, teaching fellow, Washington University; Alexander Lurie, formerly horticulturist, Missouri Botanical Garden; R. A. McGinty, formerly Rufus J. Lackland research fellow; Takashi Matsumoto, formerly laboratory assistant, recently appointed professor of botany (on leave), Imperial College of Agriculture and Forestry, Morioka, Japan; E. B. Payson, Rufus J. Lackland research fellow; Henry Schmitz, formerly Rufus J. Lackland research fellow; R. W. Webb, research assistant; and F. S. Wolpert, Rufus J. Lackland research fellow. In addition, there have been in residence, using the facilities of the laboratory and herbarium in research: Dr. E. R. Allen, formerly associate in biochemistry, Washington University School of Medicine; Dr. Norma E. Pfeiffer, assistant professor of botany, University of North Dakota; Dr. S. M. Zeller, formerly investigator, Yellow Pine Association; and Emily Schroeder, formerly research assistant.

For 1919-20 the following were appointed to Rufus J. Lackland fellowships: G. M. Armstrong, B. S. Clemson College,

M. A. University of Wisconsin, formerly extension pathologist, Bureau of Plant Industry; W. H. Chambers, B. S. and M. S. University of Illinois, formerly assistant in dairy bacteriology, University of Illinois; C. R. Hursh, B. S. University of Missouri, recently assistant pathologist, Bureau of Plant Industry; E. B. Payson, B. A. University of Wyoming; and F. S. Wolpert, A. B. University of Montana, formerly assistant in botany, University of Montana.

Other appointments for the same period were as follows: Joanne L. Karrer, B. S. University of Washington, 1915, M. S. University of Washington, 1916, teacher of biology and chemistry in Puyallup High School, 1918, reappointed second year, teaching fellow, Washington University; Adele Lewis Grant, B. S. University of California, 1902, teacher at Fresno Normal Summer School at Huntington Lake, California, A. M. Washington University, 1919, reappointed second year, teaching fellow, Washington University; and R. W. Webb, B. S. Clemson College, 1918, and A. M. Washington University, 1919, research assistant.

Graduate students terminating their connection with the Garden after receiving degrees were as follows: Mr. Alexander Lurie, to enter commercial floricultural work in Ann Arbor, Michigan; Professor R. A. McGinty to return to the Colorado State College as associate professor of horticulture, Fort Collins, Colorado; and Dr. Henry Schmitz to accept a position as assistant professor of forestry in the University of Idaho, Moscow, Idaho.

At the commencement of Washington University, June 12, the degree of Doctor of Philosophy was conferred upon Henry Schmitz, with a thesis on "Studies in the Physiology of the Fungi. VI. The Relation of Bacteria to Cellulose Fermentation Induced by Fungi, with Special Reference to the Decay of Wood." The degree of Master of Arts was conferred upon the following: Adele Lewis Grant, with a thesis, "Preliminary Study of the Morphology and Taxonomy of Mimulus"; Alexander Lurie, with a thesis, "Mosaic Diseases in Plants"; R. A. McGinty, with a thesis, "Diastase Activity in Relation to Stage of Development and Carbohydrate Content of the Tuber of Solanum tuberosum"; and R. W. Webb, with a thesis, "Studies in the Physiology of the Fungi. X. Germination of the Spores of Certain Fungi in Relation to Hydrogen Ion Concentration."

Publications and Papers.—The various papers which have been published during the year either in the ANNALS or in

other journals are included by title in the list given below. No small part of the investigations completed remain unpublished, and it may be noted in particular that considerable attention has been paid in the graduate laboratory to the mineral nutrition or salt requirements of the higher plants as affected by hydrogen ion concentration. Likewise, various aspects of the relation of hydrogen ion concentration to other life phenomena have received extensive consideration.

Allen, E. R. "Some Conditions Affecting the Growth and Activities of Azotobacter chroococcum." Ann. Mo. Bot. Gard., 1919.

Allen, E. R., and Davisson, B. S. "An All-Glass Nitrogen Apparatus." Ann. Mo. Bot. Gard., 1919.

Burt, E. A. "An Edible Garden Hebeloma." Ann. Mo. Bot. Gard., 1919.

Burt, E. A. "Merulius in North America, Supplementary Notes." Ann. Mo. Bot. Gard., 1919.

Burt, E. A. "Protomerulius Farlowii Burt, n. sp." Ann. Mo. Bot. Gard., 1919.

Burt, E. A. "The Thelephoraceae of North America. XI." Ann. Mo. Bot. Gard., 1919.

Dodge, C. W. "Tyrosin in the Fungi: Chemistry and Methods of Studying the Tyrosinase Reaction." Ann. Mo. Bot. Gard., 1919.

Duggar, B. M. "Botany." Am. Year Book, 1919.

Duggar, B. M. "The Micro-Colorimeter in the Indicator Method of Hydrogen Ion Determination." Ann. Mo. Bot. Gard., 1919.

Duggar, B. M. "Some Factors in Plant Physiological Research." Plant World, 1919.

Duggar, B. M. (Thirty-five abstracts of physiological articles in) Bot. Abstr., 1919.

Duggar, B. M., and Davis, Anne W. "Seed Disinfection for Pure Culture Work: Use of Hypochlorites." Ann. Mo. Bot. Gard., 1919.

Duggar, B. M., and Dodge, C. W. "The Use of the Colorimeter in the Indicator Method of H Ion Determination with Biological Fluids." Ann. Mo. Bot. Gard., 1919.

Lurie, A., and Pring, G. H. "Plant Curiosities." Jour. Internat. Gard. Club, 1919.

McGinty, R. A. "Diastase Activity in Relation to Stage of Development and Carbohydrate Content of the Tuber of Solanum tuberosum." Ann. Mo. Bot. Gard., 1919.

Matsumoto, T. "Culture Experiments with Melampsora in Japan." Ann. Mo. Bot. Gard., 1919.

Moore, G. T. "Botanical Participation in War Work." Science, N. S., 1919.

Moore, G. T., and Karrer, J. L. "A Subterranean Algal Flora." Ann. Mo. Bot. Gard., 1919.

Pring, G. H. "Aquatic Plants and Their Cultivation." Aquatic Life, 1919.

Pring, G. H. "Orchids of the Missouri Botanical Garden." Gardeners' Chron. of America, 1919.

Schmitz, H. "Studies in the Physiology of the Fungi. VI. The Relation of Bacteria to Cellulose Fermentation Induced by Fungi, with Special Reference to the Decay of Wood." Ann. Mo. Bot. Gard., 1919.

Schmitz, H., and Zeller, S. M. "Studies in the Physiology of the Fungi. IX. Enzyme Action in Armillaria mellea Vahl. Daedalea confragosa (Bolt.) Fr., and Polyporus lucidus (Leys.) Fr." Ann. Mo. Bot. Gard., 1919.

Webb, R. W. "Studies in the Physiology of the Fungi. X. Germination of the Spores of Certain Fungi in Relation to Hydrogen Ion Concentration." Ann. Mo. Bot. Gard., 1919.

Young, H. C. "Seed Disinfection for Pure Culture Work." Ann. Mo. Bot. Gard., 1919.

Zeller, S. M., and Dodge, C. W. "Arcangeliella, Gymnomyces, and Macowanites in North America." Ann. Mo. Bot. Gard., 1919.

Zeller, S. M., and Schmitz, H. "Studies in the Physiology of the Fungi. VIII. Mixed Cultures." Ann. Mo. Bot. Gard., 1919.

Zeller, S. M., Schmitz, H., and Duggar, B. M. "Studies in the Physiology of the Fungi. VII. Growth of Wood-Destroying Fungi on Liquid Media." Ann. Mo. Bot. Gard., 1919.

At the meeting of the American Association for the Advancement of Science and affiliated societies held in St. Louis, December 29–January 1, the following papers were presented by members of the staff and graduate students:

Duggar, B. M. "The Significance of Hydrogen Ion Concentration and Other Factors in a Study of the Salt Requirements of Higher Plants."

Duggar, B. M. "Mosaic Diseases—Progress in the Study of Causal Agents."

Grant, Adele Lewis. "A Discussion of the Genus Mimulus."

Matsumoto, Takashi. "Studies on Rhizoctonia."

Payson, E. B. "Geographical Distribution of the Genus Lesquerella."

In the limited space of this report it is not possible to include abstracts of the various published investigations of the year, but brief indications may be given of the general nature and significance of the papers.

Allen, E. R. (Ann. Mo. Bot. Gard. **6**:1-44) has applied to a physiological study of conditions affecting the soil nitrogen-fixing organism, *Azotobacter chroococcum,* the view that phosphorus nutrition and active acidity may have been important determining factors in the diverse results obtained by earlier investigators. By the use of colloidal solutions and a mechanical agitator for the solution cultures containing insoluble precipitates considerable light has been thrown upon the important growth factors for this organism.

Allen, E. R., and Davisson, B. S. (Ann. Mo. Bot. Gard. **6**:45-48) describe an all-glass nitrogen apparatus of Pyrex glass in which rubber stoppers are eliminated and there is effected efficient scrubbing of the entrained alkali from the steam.

Burt, E. A. (Ann. Mo. Bot. Gard. **6**:143-145) adds to his earlier communication notes on five species of Merulius in North America.

Burt, E. A. (Ann. Mo. Bot. Gard. **6**:171-174). *Hebeloma hortense,* a new species, collected in flower beds of the Missouri Botanical Garden, proves to be an edible mushroom of desirable quality and of distinctive flavor

Burt, E. A. (Ann. Mo. Bot. Gard. **6**:175-177). A new Protomerulius is described and the species named after the late Professor W. G. Farlow This species is characterized by pores more minute than those of any other known fungus. The plant as a whole is very delicate and unusual.

Burt, E. A. (Ann. Mo. Bot. Gard. **6**:252-279), continuing his monograph of the Thelephoraceae of North America, includes five genera, namely, Tulasnella, Veluticeps, Mycobonia, Epithele, and Lachnocladium, in the present article. Two new species (one in Epithele and one in Lachnocladium) are established and one species (*Pterula setosa*) transferred to Lachnocladium by Saccardo in 1880, is excluded.

Dodge, C. W. (Ann. Mo. Bot. Gard. **6**:71-92) has made a biochemical study of the amino-acid, tyrosin, as it occurs in certain fleshy fungi. His results suggest that the tyrosinase reaction is not a deamination and that the tyrosin molecule becomes more complex prior to decomposition.

Duggar, B. M. (Ann. Mo. Bot. Gard. **6**:179-181), improving upon the method of hydrogen ion determination by the indicator method mentioned above, shows that the Du Boscq micro-colorimeter may be employed with very small quantities of fluids and without the use of special cells. The plunger tube and the usual colorimeter cup on each side of the instrument serve respectively for the shield solutions and for the sample and the standard employed.

Duggar, B. M., and Davis, Anne W. (Ann. Mo. Bot. Gard. **6**:159-170). For the cultivation of seed plants in pure cultures it is shown that for the seed tested the ordinary eau de Javel (potassium hypochlorite) is a better disinfectant than any previously employed. The advantages of this substance over alcohol, formalin, mercuric bichloride, calcium hypochlorite, etc., are obvious from the numerous tables presented.

Duggar, B. M., and Dodge, C. W. (Ann. Mo. Bot. Gard. **6**:61-70) develop a method whereby greater accuracy in the determination of the hydrogen ion concentration of biological fluids by the indicator method is effected by means of the colorimeter. In this case special cells fitting one into another are employed instead of the usual colorimeter cups. The natural color in sample biological fluids is compensated for by suitable shields of the same solution.

McGinty, R. A. (Ann. Mo. Bot. Gard. **6**:223-251) has traced the changes taking place in some of the important carbohydrates during growth of the tuber of the common potato, at the same time devoting special attention to the relative enzyme (diastase) activity as the tuber develops from an early stage to maturity.

Matsumoto, T. (Ann. Mo. Bot. Gard. **6**:306-316) presents results of infection experiments with several species of Melampsora on species of Salix and Populus in Japan, establishing more completely the relationship of these forms.

Moore, G. T., and Karrer, J. L. (Ann. Mo. Bot. Gard. **6**:280-305). From this investigation it is demonstrated that there is a subterranean or soil algal flora which is to a great degree independent of locality and character of the soil. The number of algae is not considerable but the variety almost as great as at the surface. There is a constant occurrence of *Protoderma viride*. Algal growth often extends to a depth of 100 cm.

Schmitz, H. (Ann. Mo. Bot. Gard. **6**:93-136) has contributed the first important results in a study of the effect of bac-

teria on the action of fungi causing decomposition and decay of timber. It is found that the bacteria used play no important part in the decay of wood, and the effect of these organisms on the wood-rotting fungi varies considerably with the different forms of the latter and with the different types of wood.

Schmitz, H., and Zeller, S. M. (Ann. Mo. Bot. Gard. **6**:193-200) have isolated the various ferments (enzymes) which may be found in three wood-destroying fungi (*Polyporus lucidus*, *Armillaria mellea*, and *Daedalea confragosa*) as these fungi are grown in laboratory cultures.

Webb, R. W. (Ann. Mo. Bot. Gard. **6**:201-222) presents data showing the importance of active acidity in the germination of the spores of several species of fungi. In general, it is found that the majority of the fungi used show maximum germination with a relatively high acidity. Some species show a secondary maximum at or near the neutral point, and the outstanding feature of particular interest is the relatively low percentage germination under conditions of active alkalinity. It is felt that the data here developed may be of fundamental importance in the practical study of fungicides or spray mixtures.

Young, H. C. (Ann. Mo. Bot. Gard. **6**:147-158) reviews earlier studies on seed disinfection for pure culture work, and on the basis of his experiments concludes that diverse disinfecting agents may be required depending upon the nature of the seed used or upon the conditions to which the seed have been subjected with respect to contamination by bacteria and moulds.

Zeller, S. M., and Dodge, C. W. (Ann. Mo. Bot. Gard. **6**:49-59) present descriptions and notes on the American species Arcangeliella, Gymnomyces, and Macowanites. Of the first-named genus, there are two American forms and only one which does not occur in this country. A single new species in each of the genera Gymnomyces and Macowanites is described.

Zeller, S. M., Schmitz, H., and Duggar, B. M. (Ann. Mo. Bot. Gard. **6**:137-142). It is demonstrated that many wood-destroying fungi do not grow readily in liquid media and that there is great diversity in the different forms as to the most favorable medium. Within the usual range of biological media there is no general rule which may be established as to a favorable hydrogen ion concentration.

HERBARIUM

The herbarium has made marked progress during the year in adding to its collections, in more thoroughly organizing the material of several groups of families, and in the installation of additional cases. A room on the third floor of the main building is being equipped with new steel cases which will accommodate in adequate manner for several years the rapidly growing collection of grasses.

New Accessions.—The most important single accession of the year has been that of the private herbarium of the late Mr. D. A. Watt, of Montreal, Canada. This herbarium consists primarily of ferns and fern allies and is estimated to contain about 10,700 specimens from different parts of the world, but mainly from North America. Other noteworthy accessions acquired since the last annual report are the following: from the Arnold Arboretum, 1,405 plants collected by E. J. Palmer in the Ohio River Valley chiefly in the state of Illinois; C. F. Baker, 200 "Fungi Malayana"; E. Bartholomew, 200 "North American Uredinales"; C. E. Bessey, 120 fungi of Michigan; B. F. Bush, 862 plants of Missouri, North Carolina, South Carolina, Minnesota, etc.; California Academy of Science, 242 plants of California and Alaska; J. R. Churchill, 768 plants chiefly from New England; College de Longueuil, 206 plants of Canada; F. S. Collins, 100 algae from various localities and 50 specimens of algae in the series "Phycotheca Boreali-Americana"; A. R. Davis, 312 plants of California; Rev. John Davis, 915 plants of Missouri, North Carolina, South Carolina, etc.; Alice Eastwood, 280 plants of California; A. D. E. Elmer, 1,050 plants of the Philippine Islands; W. H. Emig, 143 plants of Oklahoma; H. C. Hanson, 316 plants of Texas; J. Arthur Harris, 75 plants of Arizona; E. Hassler, 979 plants of Paraguay; R. Hoffmann, 1,002 plants of Massachusetts, Wisconsin, and Missouri; P. Jörgensen, 551 plants of Argentina; C. H. Knowlton, 250 plants of New England; E. L. Moseley, 300 plants of Ohio; New York Botanical Garden, 1,112 plants mainly from Colombia; S. B. Parish, 120 plants of southern California; Philadelphia Academy of Natural Sciences, 966 plants of Alberta and British Columbia; P. C. Standley, 3,250 plants of Mexico collected mostly by Bro. G. Arsène; F. L. Stevens, 124 fungi of Porto Rico; United States National Museum, 338 plants of North America; H. von Schrenk, 95 North American fungi;

J. R. Weir, 619 fungi mostly from western United States; A. Yasuda, 75 fungi of Japan; S. M. Zeller, 64 fungi chiefly from Oregon. A detailed list of all accessions received during the year has been recorded in the current numbers of the BULLETIN.

Mounting and Distribution.—The mounting of herbarium specimens has continued through the year, but only a little more than one-half of the number of specimens acquired has been mounted and incorporated in the organized herbarium. The sorting, identifying, and distribution of specimens of current accessions, as well as those acquired in previous years, have occupied a considerable part of the time of the small herbarium staff.

Field Work.—The field work incidental to a botanical survey of the Southwest, which has been conducted during the past five years, has been temporarily discontinued, and in lieu of it, arrangements were made with the Arnold Arboretum to secure a complete set of the plants collected in the Ohio River Valley during the entire season of 1919 by Mr. Ernest J. Palmer. Some local field work, however, has been carried on in Missouri, Illinois, and Arkansas.

Exchanges.—Several important series of herbarium specimens have been acquired from institutions and individuals with whom the Garden herbarium maintains exchange relations. No general distribution of duplicate material has been made this year.

Use of the Herbarium by Outside Botanists.—A relatively large number of visiting botanists have consulted the herbarium during the year in connection with monographic studies, but especially to examine historical type specimens. It has been found necessary to limit materially the loan of herbarium specimens, mainly on account of the risk involved in shipping but also because of the frequent fragmentation of specimens. Nevertheless, every effort has been made to facilitate as far as possible the work of specialists who are engaged in monographing technical and difficult groups as well as those occupied with intensive floristic studies. Dr. Norma E. Pfeiffer of the University of North Dakota spent the entire summer at the herbarium in continuation of her monographic study of the genus Isoetes. Substantial progress has been made in this important undertaking and the monograph is nearing completion.

Statistical Summary: (For the year ending December 31, 1919.)

Number of specimens received on new accessions:

By purchase	**21,203**		
By gift	**3,181**		
By exchange	**4,683**		
Total	**29,067**	**valued at**	**$ 2,906.70**
Number of specimens mounted and incorporated	**15,527**	**valued at**	**3,105.40**
Number of specimens discarded from the herbarium	**347**		
Number of specimens in organized herbarium	**847,707**	**valued at**	**129,411.20**
Number of specimens in unorganized herbarium (estimated)	**78,540**	**valued at**	**6,554.00**
Wood specimens, etc., supplementing the herbarium		**valued at**	**280.00**
Microscope slides, etc		**valued at**	**410.00**
Total valuation			$136,655.20

LIBRARY

The usual library work of checking up and entering current numbers of the many hundreds of serial botanical publications which the library receives annually and finally places in the form of bound volumes on the shelves has been carried on throughout the year. Accessions of other books by donation and purchase are stated in the statistical portion below.

During the latter part of 1919, many serial publications in arrears during the war have been received from Germany, and others are arriving each week but our files are far from complete as yet.

Only a very few catalogues of book offerings have yet begun to arrive from the great foreign book marts of second-hand books. These catalogues offer greatly diminished lists of scientific books in comparison with catalogues of pre-war years and seem to be largely odds and ends of old stock offered at advanced prices. In one instance a colored slip attached to the first page gives notice that prices are advanced 50 per cent above those stated in the catalogue "on account of great costs." So far, these offerings have afforded no opportunities for filling gaps of long standing in our serials.

Publications.—The current volume of the ANNALS OF THE MISSOURI BOTANICAL GARDEN, which is our principal exchange for publications of scientific societies and institutions, contains 315 pages, 5 plates, and 30 text figures, and records the results of botanical researches by the scientific staff and graduate students of the Garden. It was computed on the basis of pre-war prices that the value per year of exchanges received for the ANNALS was about $1,500. Some exchanges are received for the Garden BULLETIN. Both the ANNALS and the BULLETIN are supplied to regular subscribers; separates of the various articles in the ANNALS are for sale by the library. The cash receipts for subscriptions and separates for the year were $428.54.

Loans of Books.—The use of the library in botanical research is not limited to persons connected with the Garden. During the year there were loans of 58 works to 20 institutions for use by their investigators. Such loans are made on the interlibrary plan; the borrower makes application for the loan through the library of his university, which is responsible for the return of the book in good condition at the expiration of the term and for payment of transportation both ways. Many botanists visit the library at intervals during the year and work out matters of importance to them. The Garden is generally regarded to have the best botanical library in the United States and the best arranged for convenience of consultation.

Statistical.—There have been 422 volumes, valued at $826.27, and 1,194 pamphlets, valued at $215.20, donated to the library; and 269 volumes, valued at $1,032.63, and 18 pamphlets, valued at $15.80 purchased. The library now contains 36,646 books and 47,783 pamphlets, a total of 84,429, valued at $125,317.18. There are also 329 manuscripts, valued at $1,605.80, and 937,145 index cards, valued at $9,538.51. A total of 6,904 index cards have been added, of which 1,047 were typewritten by Garden employees, and 4,977 purchased at a cost of $117.13. The number of books bound was 216.

NOTES

Mr. G. H. Pring, Horticulturist to the Garden, lectured before the St. Louis Garden Club, December 16, on "Plant Propagation and Graftage."

Mr. Alexander Lurie, formerly Horticulturist to the Garden, visited the Garden during the meetings of the American Association for Advancement of Science.

Dr. W. W. Bonns, formerly Rufus J. Lackland Fellow, now Director Botanical Research, Eli Lilly Drug Co., Indianapolis, Indiana, recently spent two weeks at the Garden utilizing the facilities of the graduate laboratory and library.

Recent visitors to the mycological herbarium of the Garden have been Dr. E. A. Bessey, of Michigan Agricultural College, Dr. C. H. Kauffman, of the University of Michigan, Dr. Mary Whetstone, of the Minneapolis Mycological Club, and Dr. H. N. Whetzel, of Cornell University.

During the meeting of the American Association for the Advancement of Science and affiliated societies an afternoon session was arranged at the Garden on December 31 for the Botanical Society of America, the American Phytopathological Society, and the American Society of Horticultural Science. After a trip of inspection through the greenhouses and buildings, a buffet luncheon was served in the laboratories followed by a scientific program.

The mycological library and herbarium was consulted during the meetings of the American Association for the Advancement of Science by the following: Dr. J. C. Arthur, of Purdue University; Dr. H. W. Anderson, of the University of Illinois; Dr. B. B. Higgins, of Georgia Agricultural Experiment Station; Dr. H. S. Jackson, of Purdue University; Dr. C. E. Fairman, of Lyndonville, New York; Dr. L. O. Overholts, of Pennsylvania State College; Dr. C. W. Dodge, of Brown University; and Mr. E. Bethel, of Denver, Colorado.

STATISTICAL INFORMATION FOR DECEMBER, 1919

GARDEN ATTENDANCE:

Total number of visitors.....10,296

PLANT ACCESSIONS:

Total number of plants and seeds received as gifts....	199
Total number of plants distributed in exchange.....	90
Total number of seed packets distributed in exchange..	100

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought.....	50
Total number of books and pamphlets donated.....	141

HERBARIUM ACCESSIONS:

By Purchase—

Arnold Arboretum—Plants of the Ohio River Valley, chiefly Illinois, collected by E. J. Palmer.....	1,405
Rev. John Davis—Plants, mainly from South Carolina	200
A. D. E. Elmer—Plants of the Philippine Islands.....	1,050
Dr. E. Hassler—Plants of Paraguay.....	979
C. H. Knowlton—Plants of New England.....	250

By Gift—

Prof. P. J. Anderson—*Hydnum laeticolor* B. & C.....	1
Prof. E. A. Bessey—Fungi of Gogebic Co., Mich.....	4
B. F. Bush—Plants of North and South Carolina.....	133
Ira W. Clokey—*Senecio* from Colorado.....	11
Prof. W. C. Coker—Fungi of North Carolina.....	19
Mrs. Adele Lewis Grant—*Mimulus* of California.....	7
Dr. H. D. House—Fungi of New York.....	55
Dr. L. O. Overholts—*Stereum cinerascens*.....	1
E. J. Palmer—Plants of Jasper Co., Missouri.....	21
Dr. J. R. Weir—Brush disposal fungi.....	334
Dr. S. M. Zeller—Fungi of Oregon.....	41

By Exchange—

California Academy of Science, by Miss Alice Eastwood—Plants of California and Alaska.....	242
U. S. National Museum, by P. C. Standley—Specimens of *Aquilegia* from Glacier National Park.....	3
Total	4,756

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2:00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

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Missouri Botanical Garden Bulletin

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PAPHIOPEDILUM "D. S. BROWN."

Missouri Botanical Garden Bulletin

Vol. VIII St. Louis, Mo., February, 1920 No. 2

ORCHIDS FROM SEED

The restriction recently placed by the Federal Horticultural Board on the importation of orchids has given the orchid grower an extremely difficult problem to solve, especially the commercial florist who has depended absolutely upon importations. Orchid raising is in its infancy in this country, the American hybrids possibly aggregating not more than 1 per cent of those tabulated in the Orchid Stud Book. In European countries hybrids have been raised for years in the various private collections, particularly in England and Belgium. During the war the finest collections of the latter, however, were lost.

In recent years the commercial florist has sold the cattleya orchid at the same price as roses and commoner flowers, and considerable experience has been required to place the coveted flower within this reach. It is generally conceded that the cattleyas of the "labiata" type deteriorate under artificial cultivation, and periodical importations from the tropics, by the thousands of cases, have been necessary to maintain the floral supply. If the future supply will all have to be raised from the almost microscopic seeds the minimum period of five years will be necessary, and the orchid flower will again be the choice rarity of the millionaire. The germination of the seeds depends upon the action of a symbiotic mycorrhizal root fungus, without which, failure is certain. During the entire period from pollination to the flowering stage the plants demand constant attention. Eight to ten months is necessary from the pollination of the flower to the ripening of the seed pod and at least five years from pollination to production of flowers. Thus, while the orchid hybridist is waiting for his seeds to develop other hybridists experimenting with sweet-peas, carnations, water-lilies, etc., have succeeded in raising their plants to the coveted flowering stage. Few florists will therefore undertake to raise the trade cattleyas from seed.

Insects upon imported orchid plants, according to our observations covering a number of years, are extremely rare. In fact, during the last fourteen years, only two shipments were infected with borers. These are commonly referred to as the orchid fly and the dendrobium beetle, and their eradication, according to our experiments, was a simple matter. In the early stage the presence of the larvae is indicated by an abnormal swelling of the young growth from strap-shaped to pear-shaped. (See Missouri Botanical Garden BULLETIN, Vol. 4, page 88.) Orchids are generally imported to a permanent destination, unlike roses, carnations, etc., which are annually vegetated to be shipped to all parts of the country, and it is therefore policy for the florist to keep his plants under strict observation for depredating insects.

Unless the government order is rescinded the florist will have to turn from the showy epiphytic types to the terrestrial or semi-terrestrial lady's slippers. Raising even this variety from seed would not be profitable. The present stock of orchids in this country may be rapidly increased, however, by the annual division of the vegetative growths which readily adapt themselves to this medium of propagation. In the western states it is essential to divide the parent plants periodically to increase flower production.

NEW HYBRID LADY'S SLIPPER

A new hybrid lady's slipper raised in the Garden orchid houses during the last five years has just produced its first flower. This is the first slipper orchid raised at the Garden to reach the flowering stage and will bear the name of "D. S. Brown" in honor of the man who brought the Garden orchid collection up to the present standard. The parents of the hybrid were *Paphiopedilum barbatum Crossii*, a native of the Malay region, and the hybrid *P. Harrisianum superbum*. Both were dark-flowering types, but the color of the offspring is greenish yellow with a prominent white dorsal sepal, the upper portion being flushed with bright purple. The margins twist back with age, resembling *P. villosum*, the parent of *P. Harrisianum*. The general shape of the flower suggests *P. Harrisianum*, with the exception of the broad dorsal portion with its prominent venation, this being plainly indicative of *P. barbatum*.

THE TREATMENT OF LAWNS

The importance of a good lawn cannot be overestimated. Constituting, as it frequently does, from 75 to 90 per cent of the landscape effect, its condition may enhance or destroy the beauty of additional plantings of shrubs or flower-beds. In spite of this fact, the average householder, while willing to spend both money and time on flowers and vegetables, is content to let the lawn go with an occasional mowing, and then wonders why it is so difficult to maintain a good stand of grass in St. Louis. That it is not as easy to secure as satisfactory a lawn in this locality as in cooler, moister climates goes without saying, but it is likewise a fact that given the same proportionate care and attention as other outdoor gardens the results will be equally worth while. In fact, it is not until we are willing to regard the lawn as truly a garden, just as we would a collection of blooming or fruiting plants, that any real success may be attained. Fortunately, in proportion to its area a lawn once established does not require as much labor or money as most other kinds of gardens. However, one should no more think of attempting to have a lawn without properly preparing the soil, attending to the necessary fertilizing, reseeding, mowing, etc., than he should think of growing flowers and vegetables without the necessary attention.

In the March, 1913, number of the BULLETIN the subject of lawns for St. Louis was discussed and the information therein contained has been of considerable assistance to those willing to follow directions. The time seems to have arrived for a supplementary article on lawns, treated from a little different standpoint, which it is hoped may emphasize the fundamental principles in securing what is so necessary an adjunct in the proper setting of a house.

After the surface of the ground has been brought to the proper grade and all rocks and other rubbish removed, the most essential work is to prepare the ground for seeding. In the vicinity of St. Louis the surface soil consists of a clay loam, which, in its original state, is well suited to the growing of lawn grasses. In most instances, however, this top soil has been buried in the operation of grading and the stiff clay subsoil brought to the surface. It is then important to lighten and enrich the soil by plowing or spading in a heavy application of well-decomposed stable manure. This initial preparation is very important because the lawn cannot be cultivated after seeding. If good, thoroughly decomposed manure is not to be obtained, the same result may be secured by sowing

cowpeas (*Vigna sinensis*) or crimson clover (*Trifolium pratense*), turning this crop under, and adding bone meal at the rate of 600 pounds to the acre.

Having brought the surface to a very fine and mellow condition we are ready for seeding. Kentucky blue-grass (*Poa pratensis*) is the ideal lawn grass for this section of the country, but owing to its slow growth during the early stages of its life it must be mixed with some more robust-growing kind which will protect the blue-grass by its shade and prevent the growing of weeds. This is particularly important if the seed is planted in the spring of the year, when all sorts of weeds are competing with the growth of the grasses. One of the best varieties for this purpose is the red-top (*Agrostis alba* var. *vulgaris*), which is used in mixture with the blue-grass in the ratio of one to two or one to three. For quick results English rye grass (*Lolium perenne* var. *tenue*) may be used, making the mixture: blue-grass 50 per cent, red-top 25 per cent, English rye grass 25 per cent. On sloping grounds where heavy rains may wash out the seeds or young grasses before they have become thoroughly established a slight sprinkling of oats should be given. They germinate quickly and their roots hold the soil until the grasses become established. A few cuttings with the mower will eliminate the oats.

Plenty of seed should be used in starting a new lawn, 60 pounds to the acre being about the minimum. Care should be taken to apply the seed evenly, this being accomplished either by hand seeding or by the use of special seeders manufactured for the purpose. The best time for seeding is generally either early in the morning or near evening on a day when there is little or comparatively no wind. August or early September are the best months for seeding. At that time the grass seed will have very little competition with germinating weed seed and enough moisture is generally supplied by nature to establish the grasses sufficiently to stand the winter, provided a slight top dressing of well-decomposed manure or bone meal mixed with soil is applied in late autumn. The bone meal should be given at the rate of 400 pounds to the acre. If it is not possible, however, to sow seed in the autumn almost any month during the growing season will do, particularly the spring months, March, April and May. Reseeding the bare spots on the lawn may be done at any time during the year when the surface of the soil can be worked into a mellow condition with a rake. Seed should always be kept on hand for this purpose, and whenever a bare spot is noticed it should be seeded at once.

The lawn should be tamped or rolled after seeding to bring the seeds into close contact with the soil and to prevent undue evaporation of moisture. The roller should also be used in early spring to compact the soil which has been loosened by the action of thawing and freezing during the winter, and also to make the lawn smooth for mowing.

For quick results sod may be used, and steep banks and terraces should always be sodded rather than seeded, as should also the edges of roads and walks along a newly made lawn. It is important that the sod be cut as thin as possible and kept clean and free from weeds, and that the ground be properly prepared before it is laid. Sod properly cut and laid grows very easily, provided it is set firmly in the surface of the ground by the use of a roller or tamper and that it is thoroughly soaked with water until established.

Grass should be cut as soon as it is a few inches high, care being taken to see that the mower is very sharp so as not to pull out any of the young grasses. This cutting should be continued throughout the season, and it is particularly essential to have the grass short during the winter.

A good lawn will carry through the season without any artificial watering, but if a greensward is desired during the hot summer watering becomes essential. When watering, the soil should be saturated to a good depth and then not watered again until thoroughly dry. The general custom of a daily superficial sprinkling is most injurious to the lawn.

Most annual weeds are eradicated by the mower. One exception is the crab-grass (*Panicum sanguinale*), which is most destructive to lawns. It first becomes noticeable at the end of May or the beginning of June, and from that time on it grows very rapidly, spreading the more it is cut and throwing out stems which root at every node. Crab-grass may be held in check by cutting the lawn as little as possible during the month of July and the first part of August, and when cutting to adjust the mower to cut as high as possible. The leaves of the lawn grasses will then shade the soil sufficiently to keep the stems of the crab-grass from coming in contact with the soil, thereby preventing them from taking root. Then, about August 10th to 15th, the grass should be cut short, the lawn raked with a sharp-toothed iron rake to make the remaining crab-grass stand up, the grass cut very short again, and the raking repeated. After this the lawn is seeded lightly, cut again, the clippings allowed to remain to protect the seed, and the lawn watered thoroughly. It will be found that this operation has destroyed most of the crab-grass.

Perennial weeds, such as the dandelion (*Taraxacum officinale*), plantain (*Plantago Rugelii*), and burdock (*Arctium Lappa*), may be cut out with a knife, or they may be eradicated by spraying with a solution consisting of two pounds of iron sulphate dissolved in one gallon of water. This should be applied in a very fine spray, five or six times during the season, preferably on a bright day to prevent it being washed off by rain. It should be applied two or three days after mowing, and the lawn should not be mown until two or three days after. This solution will discolor clothes and stone walks.

All lawns should have a top dressing of well-decomposed stable manure at least once every three or four years, and other fertilizers should be used whenever the lawn needs enriching. Sheep manure and wood ashes are excellent for the dressing of lawns. They may be used, mixed in equal parts, at the rate of 200 pounds to the acre. In the spring, before growth commences, is the best time for application. Bone meal is a slow-working but very good lawn fertilizer and is applied in fall or winter at the rate of 400 pounds to the acre. Air-slaked lime or limestone dust will neutralize acidity in soils and make them more suitable for the growth of Kentucky blue-grass. Lime should be used as a winter dressing at the rate of 35 or 40 bushels to the acre. Nitrate of soda is a very quick-working fertilizer which makes the grass grow very fast and greatly intensifies its color. This should be applied in early spring, just as growth commences, at the rate of 200 pounds to the acre. To prevent the chemicals from absorbing the moisture of the soil or from the plant tissues the application should be made just before a rain or after watering. Commercial fertilizers should not be applied at the time of seeding, as they may destroy the seed.

JAMES GURNEY

Mr. James Gurney, head gardener emeritus to the Missouri Botanical Garden, died at the age of eighty-nine, on January 15, 1920.

Mr. Gurney came to St. Louis from England in 1867 and within a few days after his arrival entered into the employ of Mr. Shaw. From that time until Mr. Shaw's death, he was actively engaged in developing the Garden along the lines laid down by Mr. Shaw, and many of the early collections of plants and shrubs and trees were the result of Mr. Gurney's thought and care. In 1903 Mr. Gurney was relieved from active duty at the Garden, devoting all of his time to Tower

Grove Park, but he never lost his love for and interest in the Garden. Thus there has passed one of the last links between the founder of the Missouri Botanical Garden and the present day—a man who, because of his natural love for plants and flowers, and his unusual skill, has helped to build the reputation of the institution and bring it to its present stage of development.

One of the duties of Mr. Gurney as head gardener was to give instruction to the Garden pupils, and the following tribute from Professor A. T. Erwin, of the Iowa Agricultural College, is presented as an indication of the esteem in which he was held by those who were most intimately associated with him:

"The death of James Gurney marks the passing of an old and familiar figure in the history of the Missouri Botanical Garden. His career covers the history of the Garden from the very days of its inception. The writer well recalls in his course as a Garden pupil in the nineties, the many bits of early-day history he passed out to the class: 'Here was a tree planted by Mr. Shaw, in a certain year, etc.' Most every landmark about the grounds carried a page of history which Mr. Gurney could recite to you with interest and in detail if you caught him in the right mood. His going marks the passing of one of the very last of the old guard—the pioneers in the gardening profession of America.

"Mr. Gurney was by nature a plant lover and possessed to a high degree the 'plant instinct,' if I may be permitted to use the expression. In completing his lecture on any topic, he commonly wound up with the admonition, 'Treat thy plants, boys, as thee would treat thyself,' which, after all, contains a good deal of wisdom.

"The water-lilies were Mr. Gurney's hobby. When he was wanted the first place to look for him was around the lily ponds. I well recall his delight when Director Trelease reported to him that a special appropriation had been allowed for a *Victoria Regia* pond, about 1895, I think. Later he grew an immense collection of seedling nympheas, out of which he developed two or three valuable varieties.

"Temperamentally Mr. Gurney was conservative, and it was seldom that he had to back up on a statement. On one occasion we boys attempted to corner him on some mooted scientific question, so a question box was instituted and the first query ended, 'If so, why so—if not, why not?' He replied jocularly, 'Now, boys, that's a corker, isn't it?' and

passed on to the discussion of a subject with which he felt more familiar.

"In those days there was not the well-organized staff and the division of labor which exist at the Garden today. The job of head gardener often included about everything—time-keeper, label-writer, foreman, and what not. Careful, methodical, always on the job, courteous, and even-tempered even under trying conditions, the work of Mr. Gurney deserves an important place in the early-day history of the Garden and Tower Grove Park, and the Garden pupils of his day remember his labors in their behalf with reverence and appreciation."

NOTES

Mr. L. P. Jensen, Arboriculturist to the Garden, spoke before the St. Louis Garden Club, January 20, on "The Use of Nature Plants in Gardens."

Dr. C. W. Dodge, formerly Rufus J. Lackland Fellow, has recently been appointed Head of the Department of Botany at Brown University, Providence, R. I.

Mr. G. H. Pring, Horticulturist to the Garden, talked before the St. Louis Natural History Museum Association, at the Central Library, February 18, on "Curiosities of Plant Life."

Mr. L. P. Jensen, Arboriculturist to the Garden, represented the National Gardeners' Association at the meeting of the Board of Directors of American Florists and Ornamental Horticulturists, at Cleveland, January 23-24.

Recent visitors to the Garden include Dr. I. S. Maclean, of the University of London, January 30; Dr. A. H. R. Buller, Professor of Botany, University of Manitoba, Winnipeg, Canada, February 7; Mr. R. J. Mohr, of Chicago, a former pupil in the School for Gardening, February 21.

STATISTICAL INFORMATION FOR JANUARY, 1920

GARDEN ATTENDANCE:

Total number of visitors	3,599

PLANT ACCESSIONS:

Total number of plants received as gifts	1
Total number of plants distributed in exchange	2

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	58
Total number of books and pamphlets donated	52

HERBARIUM ACCESSIONS:

By Purchase—

T. S. Brandegee—Plants of Mexico, collected by C. A. Purpus in 1919	100
A. A. Heller—Plants of Oregon and California	400
A. S. Kalenborn—Plants of the high Andes of Peru	141
Frank C. Seymour—Plants of Hampden County, Massachusetts	94
Th. Oswald Weigel—"Westfälische Pilze" coll. by W. Brinkmann	24
Th. Oswald Weigel—"Mycotheca Brasiliensis" Cent. I., Nos. 1-100 inclusive	100

By Gift—

E. Bartholomew—Thelephoraceous fungi	3
Ira W. Clokey—*Senecio amplectens* Gray from Colorado	1
C. C. Deam—Senecios from Indiana	8
Mrs. Adele Lewis Grant—*Mimulus tricolor* Lindl. and *M. modestus* Eastw. from California	2
Dr. B. B. Higgins—*Septobasidium pseudopedicellatum*	1
O. S. Ledman—Cultivated specimen of *Schinus molle* L.	1
C. G. Lloyd—*Stereum ochraceo-flavum* and *S. sanguinolentum*	2
Dr. L. O. Overholts—*Hebeloma hortense* Burt	1
Prof. Morton E. Peck—Senecios from Oregon	13
W. W. Peterson—Cultivated specimen of *Plumbago capensis* Thunb.	1
F. Weiss—Fungi of Minnesota	6
Erdman West—*Merulius corium*	1
Fred. T. Williams—*Ilex decidua* Walt. from Missouri	1
	900

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2:00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

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Farm and Stables.

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Construction.

Missouri Botanical Garden Bulletin

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COLLECTING NATIVE PLANTS FOR THE GARDEN

Native plants, well suited as they naturally are, to local climatic and soil conditions, are without a doubt the most satisfactory for gardens in the vicinity of St. Louis and should be used to a much greater extent than exotic materials. It should not be concluded, however, that because a plant is native to this section it will grow under all conditions, or that all of them are easily transplanted from their own environment into gardens. This idea has resulted in a ruthless destruction of some of our most desirable and valuable native plants, first in the vicinity of larger cities, and, in later years, owing to the popularity of the automobile, in ever-widening circles, with the result that native material is becoming scarcer each year. Many desirable things which were abundant near the city of St. Louis a few years ago are now found in only a few almost inaccessible or well-guarded locations. It is for this reason that a careful study should be made of the requirements of native plants as to soil, moisture, and light, so as to establish these conditions before attempting to introduce the plants into the plantations of local gardens.

In the series of articles which is to follow, the object is not only to popularize the use of our native plants in the garden, and if possible to create a horticulture particularly suited to local conditions, but also to indicate the requirements of these plants as to soil and environment. Such directions as are given should, of course, be supplemented by personal observation.

Large trees and shrubs should never be removed from their native habitat except by persons skilled in such work. Small plants may be collected and transplanted successfully if care is taken to secure as much of the root growth as possible, reducing the top of the plant to a size comparable to the spread of the roots taken up. In many instances the removal of the entire top is necessary. The roots must be kept moist from the moment the plant is dug until it is re-

planted, by wrapping them or the entire plant in paper or burlap. Woody plants should be collected during the fall, winter, or early spring months, while in dormant condition.

Hardy herbaceous perennials can be most successfully moved while dormant. However, they may also be transplanted at other times of the year with fair success, if lifted carefully with a lump of earth adhering to their roots, kept moist until planted, and practically all of their leaves removed, to prevent undue evaporation of moisture until the plant is established in its new home. Plants must be watered immediately after transplanting and shaded for a few days.

Plants which are rare in any locality should be moved only by one whose experience will guarantee a successful result, and such plants may generally be purchased from men who make a specialty of growing them, or who are collecting them in other localities where they are plentiful. The scarcity of a plant in a certain section of the country does not always indicate its scarcity in another.

Native plants needing protection.—The following plants, formerly abundant in this vicinity, are becoming very rare, some of them almost, if not entirely, exterminated. For this reason they should not be collected for any purpose whatsoever, but should be left to be admired in their native habitat.

BOTANICAL NAME	COMMON NAME
Amelanchier canadensis	June-berry
Aquilegia canadensis	Columbine
Aster Novae-Angliae	New England aster
Camassia Fraseri	Wild hyacinth
Ceanothus americanus	New Jersey tea
Cornus florida	Flowering dogwood
Cornus paniculata	Panicled dogwood
Cypripedium candidum	Small white lady's slipper
Cypripedium parviflorum	Small yellow lady's slipper
Cypripedium pubescens	Yellow lady's slipper
Dodecathcon Meadia	Shooting-star
Erythronium albidum	White dog's tooth violet
Erythronium americanum	Yellow dog's tooth violet
Euonymus atropurpurea	Strawberry bush
Filices, all species	Ferns
Gentiana, all species	Gentians
Hepatica acutiloba	Sharp-lobed liver-leaf
Hepatica triloba	Round-lobed liver-leaf
Ilex decidua	Winterberry
Iris hexagona	Southern blue flag
Iris versicolor	Large blue flag
Lilium canadense	Wild yellow lily
Lilium philadelphicum	Wood lily
Lilium superbum	Turk's-cap lily
Lobelia cardinalis	Cardinal flower

Orchis spectabilis.....Showy orchid
Physostegia virginiana.....False dragon-head
Rosa, all species.....Roses
Sabbatia angularis.....Rose pink
Smilacina racemosa.....False Solomon's seal
Trillium grandiflorum.....Large-flowered wake-robin
Verbena canadensis.....Showy verbena
Viola pedata.....Bird's-foot violet

In order that the citizens of St. Louis may be able to make the most intelligent use of native material, lists of the wild plants of the eastern United States suitable for various kinds of planting, will be printed in the BULLETIN during the current year. There will be included lists on native plants for water gardens, native perennials for the hardy border, native hardy vines, native trees and shrubs with conspicuous flowers, fruit, colored bark, or autumn foliage, native trees for streets, and shrubs for streets, parks, and home grounds, native plants for poor soil and smoky, unfavorable city conditions, and native conifers for gardens which are not in the smoky atmosphere of large cities.

NATIVE PLANTS SUITABLE FOR THE GARDENS OF MISSOURI AND ADJOINING STATES

I. NATIVE PLANTS FOR ROCK GARDENS

A rock garden should, in a small way, be a duplication of a natural rocky bank or similar situation where considerable variation in soil and light conditions will permit the growing of a large variety of plants.

In this region the popular notion of confining a rock collection to alpine and other plants of high altitude must be abandoned, as these plants will not stand our changeable climatic conditions. Such plants are well adapted to many of the eastern and northern states, as well as some European countries, and the directions for rock gardens given in various books apply only to those sections. Fortunately the eastern United States is particularly rich in planting materials suitable for rock-garden work, and if only native material or such exotic species as experience has proved of value be used, some very satisfactory results may be obtained.

The purpose of this article is to discuss the native plants exclusively and to include only those which are of compact growth and neat habit, omitting any which spread rapidly underground and are likely to become obnoxious or difficult to eradicate. The plants listed are mostly hardy herbaceous perennials, and the few annuals and biennials are such as

readily reproduce themselves from seed. A very few low, rock-loving shrubs have also been included.

Many of these plants may be obtained from American nurserymen and collectors, and those not at present offered by the trade will no doubt be available as soon as their value has been demonstrated. Until then they must be collected from their natural haunts, which in itself is a worth-while recreation for the maker of a rock garden.

NATIVE PLANTS SUITABLE FOR THE GARDENS OF MISSOURI AND ADJOINING STATES.

Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
3-8 **Agave virginica*	False aloe	2-6′	Greenish yellow	May-June
8 *Allium stellatum*	Prairie wild onion	8-18″	Rose	July-Aug.
8 *Arabis confinis*	Purple rock-cress	1-3′	White or pink	June-July
8 *Arabis Ludoviciana*	Virginia rock-cress	1-3′	White	March-May
8 *Arabis lyrata*	Lyre-leaved rock-cress	4-12″	Pure white	April-Sept.
8 *Arabis patens*	Spreading rock-cress	1-2′	White	Summer
8 *Arabis perfoliata*	Tower mustard (biennial)		Yellowish-white	May-Aug.
8 *Arenaria stricta*	Rock sandwort (tufted)	6-16″	White	June-July
8 *Asplenium ebeneum*	Spleenwort	8-15″	Fern	
8 *Asplenium Trichomanes*	Maidenhair spleenwort	3-8″	Fern	
9 *Aster linariifolius*	Savory-leaved aster (low, tufted)	6-12″	Violet	July-Oct.
8 *Aster oblongifolius*	Aromatic aster	1-2½′	Violet-purple	Aug.-Oct.
8 *Astragalus distortus*	Bent milk-vetch	8-15″	Purple	March-July
9 *Baptisia bracteata*	Large-bracted wild indigo	1-1½′	Cream	April-May
8 *Ceanothus ovatus*	Smaller red-root (shrub)	1-2′	White	May-June
8 *Cheilanthes lanuginosa*	Woolly lip-fern	6-18″	Fern	
3 *Delphinium tricorne*	Dwarf larkspur	1′	Blue or white	May

*Key to soil conditions:

1. Clay.
2. Clay subsoil.
3. Clay loam.
4. Loam.
5. Leafmold.
6. Gravelly soil.
7. Sandy loam.
8. Disintegrated limestone.
9. Disintegrated flint.

Two or more numbers indicate a combination of soil conditions: for example, 2-4 is loam with a clay subsoil.

	Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
3	*Dicentra eximia*	Wild bleeding-heart	1′	Pink	May-Sept.
8	*Draba cuneifolia*	Whitlow grass	4-6″	White	March-April
8	*Echinacea pallida*	Pale purple cone-flower	1-3′	White or pink	July-Oct.
8	*Echinacea paradoxa*	Yellow cone-flower	3′	Yellow	July-Oct.
3	*Galium circaezans*	Wild licorice	1′	White	May-July
3	*Galium concinnum*	Shining bedstraw	6″	White	June-Aug.
3	*Gypsophila muralis*	Low gypsophyll (annual)	4-7″	White	June-Sept.
8	*Heuchera villosa*	Hairy heuchera	1-2′	White	June-Sept.
2	*Hydrangea radiata*	Downy hydrangea (shrub)	1-3′	White	June-July
8	*Hypericum densiflorum*	Bushy St. John's-wort (shrub)	1-3′	Yellow	July-Sept.
8	*Hypericum prolificum*	Shrubby St. John's-wort (shrub)	1-3′	Yellow	July-Sept.
8	*Hypericum sphaerocarpum*	Round-podded St. John's-wort (shrub)	1-2′	Yellow	July-Sept.
8	*Juniperus nana*	Low juniper (evergreen, low, depressed)	18″		
8	*Juniperus Sabina*	Shrubby red cedar (evergreen, procumbent)	4′		
9	*Lechea major*	Hairy pinweed	1-2′	Purplish	July-Aug.
9	*Lechea thymifolia*	Thyme-leaved pinweed	6-2′	Purplish	Aug.-Sept.
9	*Lechea tenuifolia*	Narrow-leaved pinweed	4-10″	Red-purple	July-Aug.
8	*Leavenworthia Michauxii*	Michaux's leavenworthia (tufted)	3-6″	White or purplish	April
9	*Lespedeza repens*	Creeping bush-clover (trailing)		Violet-purple	Aug.-Sept.
8	*Lithospermum canescens*	Hoary puccoon	6-18″	Orange	April-June
8	*Monarda Bradburiana*	Bradbury's monarda	1-2′	Purple	May-July
8	*Oenothera missouriensis*	Missouri primrose	1′	Yellow	May-July
8	*Ophioglossum vulgatum*	Adder's-tongue	2-12″		May-Aug.
8	*Opuntia missouriensis*	Many-spined opuntia (prostrate)		Yellow	May-June
8	*Opuntia Rafinesquii*	Western prickly pear (prostrate)		Yellow	Summer
2	*Panicum virgatum*	Smooth panicum	2-3′	Grass	Aug.-Oct.

	Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
8	*Pellaea atropurpurea*	Cliff-brake	4-12″	Fern	
3	*Phlox stellaria*	Chickweed phlox	3-8″	Pale blue	April-May
3	*Phlox subulata*	Moss pink (matted)	2-6″	Pink, purple, white	April-May
8	*Pimpinella integerrima*	Yellow pimpernel	1-3′	Yellow	May-June
8	*Potentilla tridentata*	Three-toothed cinquefoil	1-12″	White	June-Aug.
8	*Ranunculus Harveyi*	Harvey's buttercup	8-18″	Bright yellow	April-May
8	*Rhus canadensis*	Fragrant sumach (shrub)	3-5′	Yellow	March-April
2	*Ribes gracile*	Missouri gooseberry (shrub)	3-5′	White	May
8	*Rudbeckia fulgida*	Orange cone-flower	1-3′	Yellow, orange base	Aug.-Oct.
8	*Ruellia ciliosa*	Hairy ruellia	1-15″	Blue	June-Sept.
7	*Saxifraga Michauxii*	Michaux's saxifrage	6-20″	White	May-Sept.
7	*Saxifraga virginiensis*	Early saxifrage	1-2′	White or purplish	March-May
3	*Sedum pulchellum*	Widow's cross (trailing)		Rose-purple	May-July
3	*Sedum telephioides*	American orpine (tufted)	1-2′	Purple	Aug.-Sept.
3	*Sedum ternatum*	Wild stone-crop (low, tufted)		White	April-June
4-8	*Selaginella rupestris*	Club moss	6-8″		Spring
3	*Silene pennsylvanica*	Wild pink (tufted)	4-10″	Pink	April-June
7	*Solidago bicolor*	White golden-rod	6″-4′	Yellowish white	July-Sept.
8	*Solidago Drummondii*	Drummond's golden-rod	1-3′	Yellow	Sept.-Oct.
8	*Solidago humilis*	Rock-bank golden-rod	6-18″	Yellow	July-Sept.
9	*Solidago radula*	Rough golden-rod	1-3′	Yellow	Aug.-Sept.
8	*Solidago rupestris*	Rock golden-rod	2-3′	Yellow	Aug.-Sept.
8	*Solidago squarrosa*	Ragged golden-rod	2-5′	Yellow	Aug.-Oct.
7	*Talinum teretifolium*	Fame flower	4-12″	Pink	May-Aug.
8	*Verbena Aubletia*	Large-flowered verbena		Blue, purple	April-June
9	*Viola pedata*	Bird's-foot violet (tufted)	3-10″	Lilac or blue	April-May

PLANTS GROWING AMONG ROCKS IN MOIST AND SHADY SITUATIONS

Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
3 *Allium Schoenoprasum*	Chives	1′	Pink, purple	June-July
8 *Aquilegia canadensis*	Wild columbine	1-2′	Scarlet and yellow	April-July
8 *Arabis laevigata*	Smooth rock-cress	1-3′	Greenish white	April-May
3 *Campanula rotundifolia*	Harebell	6″-2′	Blue	June-Sept.
3 *Camptosorus rhizophyllus*	Walking-leaf	4-9″	Fern	
3 *Corydalis flavula*	Pale corydalis	6-14″	Yellow	May-June
3 *Dentaria diphylla*	Two-leaved toothwort	8-14″	White	April-May
3 *Dentaria heterophylla*	Slender toothwort	10-14″	Light purple	April-May
3 *Dentaria laciniata*	Cut-leaved toothwort	8-15″	White or pink	April-June
3 *Dicentra canadensis*	Squirrel-corn	6-12″	White	May-June
3 *Dicentra Cucullaria*	Dutchman's breeches	5-10″	White	April-May
3 *Dodecatheon Meadia*	Shooting-star	1′	Rose	May-June
3 *Erythronium americanum*	Yellow adder's tongue	6″-1′	Yellow	March-May
3 *Erythronium albidum*	White adder's tongue	6″-1′	White	March-May
2 *Gillenia stipulacea*	American ipecac	2-3′	White	June-July
2 *Gillenia trifoliata*	Bowman's root	2-3′	White or pinkish	May-July
5-8 *Hepatica triloba*	Round-leaved liverleaf	4-6″	Blue, purple, white	March-May
8 *Heuchera americana*	Alum-root	2-3′	Greenish	May-Aug.
8 *Heuchera Rugelii*	Rugel's heuchera	6″-2′	White	July-Sept.
3 *Hypericum cistifolium*	St. John's-wort (shrub)	1-2′	Yellow	July-Sept.
7 *Mitella diphylla*	Mitre-wort	6-18″	White	April-May
3 *Polygala Senega*	Seneca snakeroot	6-12″	White	May-June
3 *Potentilla fruticosa*	Shrubby cinque-foil (shrub)	6-12″	Bright yellow	June-Sept.
8 *Ribes Cynosbati*	Wild gooseberry (shrub)	3-5′	Green	April-June
8 *Sanguinaria canadensis*	Blood-root	6-14″	White	March-April
7 *Saxifraga Forbesii*	Cliff saxifrage	1-3′	White	May
3 *Thalictrum purpurascens*	Purple meadow-rue	2-4′	Purple	May-June
3 *Tiarella cordifolia*	False mitre-wort	6-12″	White	April-May

Botanical name	Common name	Approx height	Color of flowers	Approx. time of bloom
3 *Trillium erectum*	Ill-scented wake-robin	8-16″	White	April-May
5-3 *Trillium grandiflorum*	Large-flowered wake-robin	6-12″	Pink, white	April-May
3 *Trillium recurvatum*	Prairie wake-robin	6-18″	Purple	April-May
3 *Trillium sessile*	Sessile-flowered wake-robin	4-12″	Purple	April-May
5-3 *Uvularia grandiflora*	Large-flowered bellwort	1-2′	Yellow	April-May
5-3 *Uvularia perfoliata*	Perfoliate bellwort	6-20″	Yellow	April-May
3 *Veratrum Woodii*	False hellebore	2-5′	Purple	June-July
3 *Woodsia obtusa*	Blunt-lobed woodsia	3-6″	Fern	

PLANTS GROWING IN DRY, SANDY, SUNNY SITUATIONS

7 *Arenaria caroliniana*	Pine-barren sandwort	4-10″	White	May-July
3 *Ascyrum Crux-Andreae*	St. Andrew's cross (shrub)	5-10″	Bright yellow	July-Aug.
3 *Ascyrum stans*	St. Peter's-wort	1-2′	Bright yellow	July-Aug.
3 *Aster gracilis*	Graceful aster	1-2′	Violet	July-Sept.
3 *Centrosema virginianum*	Spurred butterfly-pea (trailing)		Violet	July-Aug.
7 *Hypericum nudicaule*	Orange-grass (annual)	4-20″	Yellow	June-Oct.
3 *Lupinus perennis*	Wild lupine	1-2′	Blue	May-June
7 *Oenothera sinuata*	Evening primrose	6-18″	Yellow	May-June
8 *Tragia nepetaefolia*	Catnip tragia	6-15″	Greenish	May-Oct.
9 *Vaccinium vacillans*	Low blueberry (shrub)	1-3′	White	May-June

The list above enumerates only plants which actually prefer rocky situations for their growth, and many of these will not succeed elsewhere. These do not, however, exhaust the available native material for rock-garden purposes, and the following list includes a large number of beautiful plants which, while not actually growing in rocky situations, are still suitable for a rock garden.

PLANTS GROWING IN DRY SOIL IN SUNNY SITUATIONS

Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
3 *Anemone cylindrica*	Long-fruited anemone	2′	Greenish white	June-Aug.
3 *Antennaria plantaginifolia*	Plantain-leaf everlasting	6-18″	Greenish white	April-June
7 *Arenaria patula*	Sandwort (annual)	4-10″	White	April-May
8 *Asclepias tuberosa*	Butterfly-weed	1-2′	Orange	June-Sept.
8 *Asclepias verticillata*	Whorled milkweed	1-2′	White	July-Sept.
8 *Aster laevis*	Smooth aster	2-3′	Blue-violet	Sept.-Oct.
3 *Aster multiflorus*	Dense-flowered aster	1-3′	White	Aug.-Nov.
3 *Aster patens*	Late purple aster	1-3′	Purplish blue	Aug.-Oct.
3 *Aster turbinellus*	Prairie aster	2-3′	Violet	Sept.-Oct.
3 *Baptisia leucantha*	Large white wild indigo	2-3′	White	June-July
3 *Baptisia tinctoria*	Wild indigo	1-2′	Yellow	June-Sept.
3 *Cassia nictitans*	Wild sensitive plant	6-15″	Yellow	July-Oct.
3 *Clitoria Mariana*	Butterfly-pea	1′	Pale blue	June-July
3 *Crassina grandiflora*	Prairie zinnia	4-6″	Yellow	
3 *Croton capitatus*	Capitate croton (annual)	1-1½′	Silvery	June-Sept.
3 *Croton monanthogynus*	Single-fruited croton (annual)	4-8″	Silvery	
3 *Euphorbia corollata*	Flowering spurge	10″-3′	White	April-Oct.
3 *Gnaphalium polycephalum*	Sweet balm (annual)	1-3′	White	Aug.-Sept.
3 *Helianthus occidentalis*	Sunflower	2-3′	Yellow	Aug.-Sept.
9 *Hieracium Gronovii*	Hairy hawkweed	1-3′	Yellow	July-Sept.
9 *Hypoxis erecta*	Star-grass	2-6″	Yellow	May-Oct.
9 *Lespedeza procumbens*	Trailing bush-clover (low, trailing)	1-3′	Violet or pink	Aug.-Sept.
9 *Lespedeza violacea*	Bush-clover	1-3′	Violet-purple	Aug.-Sept.
3 *Liatris cylindracea*	Cylindric blazing-star	1-1½′	Purple	July-Sept.
8 *Liatris punctata*	Dotted button-snakeroot	6-30″	Purple	Aug.-Oct.
9 *Liatris scariosa*	Large button-snakeroot	1-6′	Bluish purple	Aug.-Sept.
8 *Liatris squarrosa*	Blazing-star	6″-2′	Bright purple	June-Sept.

	Botanical name	Common name	Approx height	Color of flowers	Approx. time of bloom
3	*Liatris elegans*	Handsome blazing-star	2-3′	Rose	Aug.-Oct.
3	*Liatris graminifolia*	Loose-flowered button-snakeroot	1-3′	Purple	Aug.-Sept.
3	*Melampodium cinereum*	Pale melampodium	4-12″	White	June-Oct.
3	*Oenothera triloba*	Three-lobed primrose	3-12″	White or pink	May-July
3	*Phlox amoena*	Hairy phlox	6-18″	Pink or white	April-May
3	*Phlox pilosa*	Downy phlox	1-2′	Pink, purple or white	April-May
3	*Potentilla argentea*	Samson's snakeroot		Blue-purple	March-July
3	*Psoralea melilotoides*	Silvery cinque-foil (low, tufted)	1-2′	Yellow	May-Sept.
3	*Salix tristis*	Dwarf gray willow (shrub)	2-3′	Inconspicuous	March-April
3	*Schrankia uncinata*	Sensitive briar	2-4′	Pink	May-July
3	*Scutellaria resinosa*	Resinous skullcap	6-10″	Violet	May-Aug.
3	*Solidago nemoralis*	Field golden-rod	6″-2′	Yellow	July-Nov.
3	*Solidago petiolaris*	Downy golden-rod	1-3′	Yellow	Sept.-Oct.
3	*Viola palmata*	Early blue violet (low, tufted)		Blue	April-May

PLANTS GROWING IN DRY SOIL IN SHADY SITUATIONS

8	*Blephilia ciliata*	Downy blephilia	1-2′	Purple	June-Aug.
9	*Ceanothus americanus*	New Jersey tea (shrub)	1-3′	White	May-July
9	*Cunila Mariana*	Stone mint	8-20″	Purple-pink	Aug.-Sept.
3	*Iris cristata*	Crested dwarf iris	1-3″	Blue	April-May
3	*Iris verna*	Dwarf iris	1-3″	Yellow	April-May
3	*Pedicularis canadensis*	Lousewort	6-18″	Yellow or reddish	April-June
3	*Pentstemon pubescens*	Beard-tongue	1-2′	Purple	May-July
4	*Viola pubescens*	Hairy yellow violet (low, tufted)		Yellow	April-May

PLANTS GROWING IN MOIST SITUATIONS IN OPEN SUNNY PLACES

Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
8 *Aconitum noveboracense*	New York monk's-hood	2′	Blue	May-June
3 *Anemone pennsylvanica*	Canada anemone	1-2′	White	May-Aug.
3 *Baptisia australis*	Blue false-indigo	1-3′	Blue	June-Aug.
3 *Commelina virginica*	Virginia day-flower	3′	Blue	June-Sept.
8 *Echinacea purpurea*	Purple cone-flower	2-4′	Purple	July-Oct.
3 *Eryngium yuccaefolium*	Button snake-root	2-4′	Blue	June-Sept.
3 *Eupatorium coelestinum*	Mist-flower	1-2′	Blue	Aug.-Oct.
3 *Helenium autumnale*	False sunflower	2-3′	Yellow	Aug.-Oct.
3 *Helenium nudiflorum*	Sneeze-weed	1-3′	Yellow	June-Oct.
7 *Krigia Dandelion*	Goat's-beard	6-18″	Yellow	April-June
7 *Krigia virginica*	Virginia goat's-beard	1-2′	Reddish orange	May-Oct.
8 *Liatris spicata*	Dense button-snake-root	2-3′	Blue-purple	Aug.-Sept.
3 *Mikania scandens*	Climbing hemp-weed (climber)		Flesh-color	July-Sept.
4-3 *Phlox divaricata*	Wild blue phlox (low, creeping)		Bluish	April-June
3 *Sabbatia angularis*	Rose pink (annual)	1′	Rose-pink or white	June-July
3 *Polygala sanguinea*	Purple milkwort	6-15″	Rose-purple	June-Sept.
3 *Potentilla Anserina*	Silver-weed (low, tufted, spreading)		Yellow	May-Sept.
8 *Scutellaria parvula*	Small skullcap	3-12″	Violet	April-June
3 *Thalictrum polygamum*	Tall meadow-rue	3′	White	May-June
3 *Thaspium barbinode*	Meadow parsnip	1-2′	Yellow	May-June
3 *Tradescantia virginiana*	Spiderwort	8″-3′	Blue	May-Aug.
3 *Trifolium reflexum*	Buffalo clover	10-20″	White	April-Aug.
9 *Vaccinium corymbosum*	Swamp blueberry	1-3′	White	May-June
3 *Viola sagittata*	Arrow-leaved violet (tufted, low)		Blue	April-May
3 *Zizia aurea*	Golden meadow parsnip	1-2½′	Yellow	April-July

PLANTS GROWING IN RICH SOIL AND DRY, SUNNY SITUATIONS

Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
9 *Amorpha canescens*	Lead plant (shrub)	1-3′	Blue	July-Aug.
3 *Amorpha nana*	Fragrant false indigo (shrub)	1′	Purple	May
3 *Anemone caroliniana*	Carolina anemone	3-6″	Purple	May
3 *Astragalus caryocarpus*	Ground plum	6-15″	White	April-June
3 *Astragalus mexicanus*	Larger ground plum	6-15″	Yellowish white	May
3 *Camassia Fraseri*	Wild hyacinth	1-2′	Blue-white	April-May
3 *Coreopsis palmata*	Stiff tickseed	1-3′	Bright yellow	June-July
3 *Delphinium carolinianum*	Carolina larkspur	1-2′	Blue-white	May-July
8 *Draba cuneifolia*	Wedge-leaved Whitlow-grass	4-8″	White	Feb.-April
3 *Erigeron bellidifolius*	Robin's plantain	10-24″	Violet, purple	April-June
8 *Erysimum asperum*	Western wall-flower	1-3′	Orange-yellow	May-July
3 *Gentiana puberula*	Gentian	6-10″	Lilac	Aug.-Sept.
8 *Houstonia angustifolia*	Narrow-leaved houstonia	1-2′	Purplish	May-July
3 *Houstonia caerulea*	Bluet	3-5″	Blue	March-May
3 *Houstonia minima*	Bluet	1-4″	Blue	March-July
3 *Houstonia purpurea*	Large houstonia	8-15″	Blue	May-July
3 *Liatris pycnostachya*	Hairy button-snake-root	2-5′	Purple	Aug.-Sept.
3 *Linum perenne*	Flax	1-2′	Blue	Summer
3 *Lupinus argenteus*	Silvery lupine	1-2′	Purple	July-Aug.
3 *Malvastrum coccineum*	False mallow	4-10″	Red	May-Aug.
3 *Mentzelia nuda*	Bractless mentzelia	1-5′	Yellowish white	July-Aug.
3 *Mentzelia ornata*	Ornate mentzelia	2′	Yellowish white	June-Sept.
3 *Nothoscordum striatum*	Yellow false garlic	1′	Yellow	March-July
3 *Oenothera albicaulis*	Prairie evening primrose (low, spreading)		White, pink	April-June

Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
3 *Oenothera speciosa*	Showy primrose	6"-3'	White, pink	May-July
3 *Parosela aurea*	Golden parosela	1-2'	Yellow	Summer
3 *Parosela Dalea*	Pink parosela	1-2'	Pink	Aug.-Sept.
3 *Petalostemon candidus*	White prairie clover	2-3'	White	July-Aug.
3 *Petalostemon villosus*	Hairy prairie clover	1-2'	Purple	Aug.
3 *Petalostemon violaceus*	Violet prairie clover	1-3'	Violet, purple	July-Aug.
3 *Sabbatia campestris*	Rose pink	1'	Lilac	July-Aug.
8 *Silene regia*	Royal catchfly	3-4'	Scarlet	July
3 *Sisyrinchium angustifolium*	Pointed blue-eyed grass	3-12"	Blue	May-Aug.

PLANTS GROWING IN RICH SOIL AND MOIST, SHADY SITUATIONS

3 *Aconitum uncinatum*	Wild monkshood	1-2'	Blue	June-Sept.
4-8 *Actaea alba*	White baneberry (berries white)	1-2'	White	April-June
8 *Actaea rubra*	Red baneberry (berries red)	1-2'	White	April-June
3 *Anemone virginiana*	Tall anemone	2-3'	White	June-Aug.
5-3 *Anemonella thalictroides*	Rue anemone	4-9"	White, pinkish	March-June
8 *Arabis canadensis*	Sickle-pod	1-3'	Greenish white	June-Aug.
5-3 *Aralia quinquefolia*	Ginseng	8-15"	Greenish white	July-Aug.
5-3 *Arisaema triphyllum*	Jack-in-the-pulpit	1'	Greenish brown	April-June
5-8 *Asarum canadense*	Wild ginger (low, prostrate)		Brown	May-June
5-3 *Botrychium virginianum*	Virginia grape fern		Fern	
8 *Cimicifuga racemosa*	Black snakeroot	3-5'	White	June-Aug.
3 *Claytonia caroliniana*	Carolina spring-beauty	6-12"	Pink	March-May
3 *Claytonia virginica*	Spring-beauty	6-12"	Pink	March-May
3 *Clethra alnifolia*	Sweet pepperbush (shrub)	3-10'	White	July
3 *Corydalis aurea*	Golden corydalis	6-14"	Bright yellow	March-May
3 *Erythronium albiudm*	White adder's-tongue	6-18"	White	March-May

Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
3 *Euonymus obovatus*	Running strawberry bush (low, trailing shrub)		Greenish	April-May
3 *Geranium maculatum*	Wild cranesbill	1-2′	Rose-purple	April-July
3 *Hydrastis canadensis*	Golden seal	1′	Greenish white	April-May
5-3 *Hydrophyllum virginicum*	Virginia waterleaf	1-3′	White	May-Aug.
8 *Osmorrhiza brevistylis*	Woolly sweet cicely	1-3′	White	May-June
8 *Osmorrhiza longistylis*	Smooth sweet cicely	1-3′	White	May-June
3 *Polemonium reptans*	Greek valerian	1′	Blue	April-May
3 *Polygonatum biflorum*	Hairy Solomon's seal	8″-3′	White	April-June
3 *Polygonatum giganteum*	Smooth Solomon's seal	1-5′	White	May-July
3 *Scutellaria versicolor*	Small skullcap	1-3′	Blue	June-Aug.
3 *Smilacina racemosa*	Wild spikenard	1-2′	White	May-June
3 *Solidago latifolia*	Broad-leaved golden-rod	1-3′	Yellow	July-Sept.
3 *Spiraea Aruncus*	False goat's-beard	3-5′	Yellowish white	June
3 *Thalictrum dioicum*	Early meadow rue	1-2′	Greenish	April-May
3 *Thaspium aureum*	Meadow parsnip	1-2′	Yellow	June-July
3 *Viola striata*	Pale violet (tufted)	6″	Cream-white	April-May
8 *Zizia cordata*	Heart-leaved alexanders	2-3′	Yellow	May-June

FLOWER SHOW OF THE GARDEN CLUB OF ST. LOUIS

The first annual flower show of the Garden Club of St. Louis will be held in the floral display house in the Missouri Botanical Garden, Tower Grove Avenue at Flora Boulevard, Saturday and Sunday, May 15 and 16, 1920. For the first time, the floral display house will be artificially lighted, so that those who cannot come in the day time may visit the show at night.

A cordial invitation is hereby extended to everybody and anybody living in St. Louis, St. Louis County, and the territory within a radius of twenty-five miles of the St. Louis Court House, to take part in this show. Any one who has flowers, flowering shrubs or trees, small fruits or vegetables

which he has grown himself, is invited to bring these to Shaw's Garden and exhibit them at this show and compete for the prizes offered.

There will be two classes of exhibits, one for amateurs and one for commercial growers.

The different exhibits will include cut perennials and perennials in pots, cut annuals, annuals in pots, house plants, vegetables, flowering shrubs and trees, wild flowers, etc. Any one may exhibit as many different plants or cut flowers as he desires. There will be no charge for space or admission. The object of this show is to create interest and enthusiasm in plants and flowers in St. Louis and vicinity. Few realize that a great variety of plants can be grown with success in this region, and it is hoped that everybody will help make this show worth visiting.

Every person desiring to exhibit should obtain an entry blank and exhibit tags for each variety to be shown. Exhibit blanks, tags, and premium list containing full information can be obtained by writing to Mrs. E. J. Walsh, Chairman Entry Committee, 4349 Westminster Place, St. Louis, Mo. The entry blank, properly filled out, should be returned to Mrs. Walsh. The tags are to be retained by the exhibitor and securely fastened to the exhibit.

Such shows have been held with great success in the east, and it is the intention, if enough interest is aroused, to make this spring flower show an annual event. The Missouri Botanical Garden is glad to co-operate in every way possible to make these exhibits a regular feature of the life of the city.

NOTES.

Mr. S. H. Essary, of the Tennessee Agricultural Experiment Station, spent a few days at the Garden recently, consulting the library.

Mrs. Adele Lewis Grant, Teaching Fellow in the Henry Shaw School of Botany, lectured before Asclepios, the biological society of Washington University, March 23, on "The Economic Value of Some of Our Summer Birds."

Mr. and Mrs. C. W. Deusner, the former a graduate of the School for Gardening, have resumed the practice of landscape gardening in southern California, with an office at Pasadena.

Mr. D. Miller and Mr. Adam Huber, orchid growers at the Garden, gave a talk on "Orchids," March 3, before the St. Louis Association of Gardeners.

Mr. Willard G. Bixby, Secretary of the Northern Nut Growers' Association, visited the Garden, March 24, inspected the nut plantation, and presented the Garden with several new abnormalities of nuts.

Volume VI, Number 4 of the Annals of the Missouri Botanical Garden has recently been issued with the following contents:

"The Thelephoraceae of North America. XI," E. A. Burt.

"A Subterranean Algal Flora," George T. Moore and Joanne L. Karrer.

"Culture Experiments with Melampsora in Japan," Takashi Matsumoto.

STATISTICAL INFORMATION FOR FEBRUARY, 1920

GARDEN ATTENDANCE:

Total number of visitors	9,041

PLANT ACCESSIONS:

Total number of plants and seeds received as gifts	15

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	39
Total number of books and pamphlets donated	143

HERBARIUM ACCESSIONS:

By Purchase—

E. Bartholomew—"North American Uredinales," Cent. XXII and XXIII, Nos. 2101-2300 inclusive	200
C. Mereschkovsky—"Lichenes ticinenses exsiccati"	100

By Gift—

J. S. Boyce—*Merulius* sp	2
Miss Fanny Goetz—*Mimulus modestus* Eastw. from California	1
Mrs. Adele Lewis Grant—*Mimulus*, several species from California	15
Dr. D. T. MacDougal—*Chenopodium ambrosioides* L. from the vicinity of the Mexican boundary	1
W. H. Snell—*Merulius* sp. from California	2
W. N. Suksdorf—Plants of Washington	112
Dr. S. M. Zeller—*Poria* sp	1

By Exchange—

Ira W. Clokey—Plants of Colorado	270
U. S. National Museum—"American Grasses" Nos. 401-700 inclusive	300
Total	1,004

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2:00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

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MISSOURI BOTANICAL GARDEN BULLETIN

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CLYTOSTOMA CALLISTEGIOIDES

Missouri Botanical Garden Bulletin

Vol. VIII St. Louis, Mo., April, 1920 No. 4

SOME TROPICAL WOODY CLIMBERS IN THE MAIN CONSERVATORY

Evergreen climbers, especially the woody type, are valuable in overcoming the sparseness of roof vegetation in newly planted conservatories and are particularly effective when planted at the side and trained to the ridge in a festoon arrangement. The Bignoniaceae, because of the profusion of their light purple to orange flowers, possession of tendrils as a means of support, and resistance to insect pests, are particularly well adapted to this purpose. They will likewise stand varied degrees of temperature, and when planted outside further south the plants grow rapidly, often attaining a height of twenty feet in one season. The pendant growths bear long festoons of trumpet-shaped flowers, the heads of the flowers being terminal from the young lateral shoots. Shaping or pruning the vines should be accomplished immediately after flowering.

Several genera of the Bignoniaceae are now in flower in the economic house at the Garden. The vines are planted adjacent to the steam pipes on each side of the concrete retaining wall and are supported from the ground to the ridge by a single strand of wire. This is counterbraced by suspended wires hooked to the parallel angle irons, leaving a space of two feet between the glass and support to prevent the vine from burning in summer and freezing in winter.

CLYTOSTOMA CALLISTEGIOIDES

This species, a native of Brazil, is grown extensively in Florida where it is said to withstand several degrees of frost. The flowers are about three inches long, trumpet-shaped, and produced in terminal pairs from the young growth. The corolla is vase-shaped, pale purple, streaked on the interior.

PHAEDRANTHUS BUCCINATORIUS

This is a handsome vine well adapted to cool greenhouses. It is evergreen in habit, the growth being supported by strong three-parted tendrils. The flowers are orange-red, produced in

terminal clusters, and suggest the native climber, *Tecoma radicans*. The plant differs from Bignonia by the tomentose calyx and ovary and exserted stamens.

SOLANDRA NITIDA

This is a handsome shrub-like climber of Mexico named in honor of Daniel C. Solander, a Swedish naturalist and traveler. The common species, *S. grandiflora*, has been grown in Europe in greenhouses since about 1760, and later in California and Florida, in the open. It is rarely used as a greenhouse climber in this country, however, due to its habit, which necessitates training and securing the branches to their support.

An excellent specimen of *S. nitida* may be seen in the palm house at the Garden, where it is trained up the iron girder support at the northwest corner. This plant was sent from San Diego, California, in 1912, and, due to the tropical atmosphere of the house, has grown rapidly, now reaching 30 feet in height. The flowers are showy and massive, and the foliage entire, shiny green above and whitish beneath. The branches range from several inches in diameter at the base to about the width of a thumb above.

The flowers in the bud stage resemble a drum-stick about one foot in length with four prominent indentations equally spaced upon the dilated end or apex. The persistent calyx is light green, deeply cleft, about two inches in length. The corolla is the showiest portion of the floral envelope, being vase-shaped or funnel-form, with five prominent bright yellow lobes, the interior of which are striated with a single purplish brown line. The texture of the entire corolla resembles that of a chamois skin. A disappointing feature of the flower is its short duration, the large yellow portion often dropping to the ground within twelve hours after opening. The buds, even if cut and placed in water, will not open, but will gradually shrivel and perish.

NATIVE PLANTS SUITABLE FOR THE GARDENS OF MISSOURI AND ADJOINING STATES

II. HARDY NATIVE PLANTS FOR THE WATER GARDEN

All the plants enumerated below ordinarily grow in decayed vegetable matter and consequently require a rich soil. If the soil in which these plants are to be planted is not of this nature, it must be made so artificially. A turfy loam combined with well-decayed cow manure, two parts of the former and one of the latter, makes a good mixture for the growing of these plants. The depth of this soil should be from 18 inches to 2 feet and should be composted and turned over several

BUD AND FLOWER OF SOLANDRA NITIDA.

times before using. The water-lilies will grow in water to a depth of 5-6 feet, but for artificial ponds a depth of 2-3 feet is sufficient. Most of the plants listed require an open sunny situation. Those which will grow in partial shade are marked (x).

PLANTS GROWING IN DEEP WATER OR FLOATING ON THE WATER

Botanical name	Common name	Approx. height	Color of flower	Approx. time of bloom.
Brasenia purpurea	Water-shield (in ponds)		Purple	Summer
Castalia tuberosa	Tuberous white water-lily (in ponds and lakes)		White	Summer
Castalia odorata	Sweet-scented water-lily (ponds)		White	June-Sept.
Nelumbo lutea	American lotus (lakes)		Pale yellow	July-Aug.
Nymphaea advena	Large yellow pond-lily (ponds, lakes)		Yellow	April-Sept.
Nymphaea Kalmiana	Small pond-lily (ponds)		Yellow	Summer
Nymphaea rubrodisca	Red-disked pond-lily (ponds)		Red, crimson	May-Sept.
Nymphaea sagittifolia	Arrow-leaved pond-lily (ponds)		Yellow	Summer
Orontium aquaticum	Golden club (shallow water)		Yellowish	May-June
Potamogeton diversifolius	Pond-weed (floating on water)		Red	June-Sept.
Potamogeton natans	Floating pond-weed (floating on water)		Red	June-Sept.
Thalia dealbata	Powdery thalia (in shallow water)		Bluish	June-Sept.
Utricularia vulgaris	Greater bladderwort (floating on water)		Yellow	June-Aug.

PLANTS GROWING IN WATER OR ON MARSHY SHORES

Acorus Calamus	Sweet flag	2-4′	White	May-July
Alisma Plantago-aquatica	Water plantain (shallow water or mud)	1-2′	White	June-Sept.
Calla palustris	Water arum	1-2′	White	July-Aug.
Caltha palustris	Marsh marigold	1-2′	White, pink	May-Sept.
Cephalanthus occidentalis	Button-bush (shrub)	4-10′	White	June-Sept.
Crinum americanum	Swamp lily	1-3′	Cream-white	June-July
Dianthera americana	Water-willow	1-3′	Violet	May-Aug.
Echinodorus radicans	Creeping bur-head	2-4′	White	June-July
Hymenocallis galvestonensis	Spider-lily	1-2′	White	May-July

Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom.
Itea virginica	Virginia willow (shrub)	4-10′	White	May-June
Jussiaea diffusa	Floating primrose willow (stems creeping or floating)		Yellow	June-Aug.
Ludwigia palustris	Marsh purslane (procumbent or floating stems; fine for water edges)		Inconspicuous	Summer
Lythrum alatum	Wing-angled loosestrife	1-4′	Deep purple	June-Aug.
Lythrum Salicaria	Purple loosestrife	2-3′	Purple	June-Aug.
Peltandra virginica	Green arrow-arum		Green	May-June
Planera aquatica	Water elm (tree)	20-40′	Inconspicuous	April-May
Plantago cordata	Heart-leaved plantain	6-15″	Reddish green	March-July
Pontederia cordata	Pickerel-weed	1-3′	Blue	June-Oct.
Sagittaria latifolia	Broad-leaved arrowhead	1-3′	White	July-Sept.
Saururus cernuus	Lizard's tail	2-3′	White	June-Aug.
Scirpus atrovirens	Dark green bulrush	2-4′	Inconspicuous	June-Aug.
Scirpus lacustris	Great bulrush	4-8′	Inconspicuous	June-Sept.
Scirpus lineatus	Reddish bulrush	1-3′	Inconspicuous	June-Sept.
Scutellaria galericulata	Marsh skullcap	1-3′	Blue	June-Sept.
Sparganium eurycarpum	Broad-fruited bur-reed	2-4′	Inconspicuous	May-Aug.
Steironema ciliatum	Fringed loosestrife	1-4′	Yellow	June-Aug.
Steironema quadrangulata	Prairie moneywort	10-24″	Yellow	June-July
Taxodium distichum	Bald cypress (tree)	50-100′	Inconspicuous	March-April
Typha angustifolia	Narrow-leaved cattail (fruit conspicuous)	4-8′	Inconspicuous	June-July
Typha latifolia	Cat-tail (fruit conspicuous)	4-8′	Inconspicuous	June-July

TREES AND SHRUBS GROWING IN MARSHY AND WET SOIL

Acer Drummondii	Drummond's maple (tree)	50-100′	Reddish	March-April
Alnus incana	Speckled alder (tree)	8-25′	Inconspicuous	April-May
Alnus rugosa	Smooth alder (shrub)	5-20′	Inconspicuous	March-April

Botanical name	Common name	Approx. height	Color of flower	Approx. time of bloom.
Cornus stricta	Stiff dogwood (shrub)	8-12′	White	April-May
Cyrilla racemiflora	Leatherwood (shrub or small tree)	15-30′	White	May-July
Fraxinus nigra	Black ash (tree)	40-80′	Inconspicuous	April-May
Ilex decidua	Swamp holly (shrub or small tree; berries bright red in winter)	15-25′	White	May
Leitneria floridana	Corkwood (shrub)	6-15′	Inconspicuous	March-April
Magnolia virginiana	Laurel magnolia (shrub or tree)	15-50′	White	May-June
Quercus palustris	Pin oak (tree)	50-100′	Inconspicuous	May-June
Quercus platanoides	Swamp white oak (tree)	40-80′	Inconspicuous	May-June
Viburnum cassinoides	Withe-rod	4-10′	White	June-July
Viburnum nudum	Larger withe-rod (shrub)	4-12′	White	June-July

HERBACEOUS PERENNIALS GROWING IN MARSHY AND WET SOIL

Althaea officinalis	Marsh-mallow	2-4′	White	Summer
Boehmeria cylindrica	Wild false nettle	1-3′	White	July-Sept.
(x)*Chelone glabra*	Turtle head	1-3′	Pinkish white	July-Sept.
Eupatorium perfoliatum	Boneset	2-4′	White	July-Sept.
(x)*Gentiana Andrewsii*	Closed gentian	1-2′	Blue, white	Aug.Oct.
Geum rivale	Purple avens	1-3′	Purple	May-July
Hibiscus lasiocarpos	Hairy-fruited rose-mallow	4-6′	Pink, white	August
Hibiscus militaris	Halberd-leaved rose-mallow	3-4′	Pink with dark eye	Aug.-Sept.
Hibiscus Moscheutos	Swamp rose-mallow	4-6′	Pink, white	Aug.-Sept.
Iris fulva	Copper iris	1-3′	Reddish brown	May-June
Iris hexagona	Southern blue flag	1-3′	Blue	April-May
Iris versicolor	Large blue flag	1-3′	Blue	May-July
Liatris spicata	Dense snakeroot	2-4′	Blue	Aug.-Oct.
(x)*Lobelia cardinalis*	Cardinal flower	2-4′	Cardinal	July-Sept.
Lobelia syphilitica	Large blue lobelia	1-3′	Blue	July-Oct.
Mimulus alatus	Sharp-winged monkey flower	1-3′	Violet	June-Sept.
Mimulus ringens	Square-stemmed monkey flower	1-3′	Violet	June-Sept.

Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom.
Poterium canadense	American great burnet	2-4′	White	July-Oct.
Solidago sempervirens	Sea-side golden-rod	3-5′	Bright yellow	Aug.-Nov.
Trollius laxus	American globe-flower	1-2′	Yellowish, purplish	May-July

SHRUBS GROWING IN VERY MOIST SOIL

Adelia acuminata	Adelia (shrub or small tree)	15-25′	Greenish yellow	March-April
Betula pumila	Low birch	4-12′	Inconspicuous	May-June
Fothergilla carolina	Fothergilla	2-5′	White, pink	April
Rhamnus frangula	Alder buckthorn	4-6′	Greenish	May-June
Spiraea salicifolia	Meadow-sweet	2-4′	White, purple	June-Aug.
Spiraea tomentosa	Steeple-bush	1-3′	Pink, purple	July-Sept.

PERENNIALS GROWING IN VERY MOIST SOIL

Amsonia Tabernaemontana	Amsonia	1-3′	Blue	April-July
Asclepias incarnata	Swamp milkweed	2-4′	Pink	July-Sept.
Aster novi-belgii	New York aster	1-3′	Violet	Aug.-Oct.
Boltonia asteroides	Aster-like boltonia	3-6′	White, pinkish	July-Sept.
Boltonia decurrens	Clasping-leaved boltonia	3-6′	Purple	Aug.-Sept.
Boltonia latisquama	Broad-scaled boltonia	3-6′	Violet-blue	July-Sept.
Cardamine bulbosa	Bulbous cress	6-18″	White	April-June
Helenium autumnale	Sneeze-weed	2-4′	Yellow	Aug.-Oct.
Melanthium virginicum	Bunch-flower	2-4′	White	June-Aug.
(x) *Physostegia virginiana*	False dragon-head	1-3′	Rose	July-Sept.
(x) *Senecio aureus*	Golden ragwort	1-2′	Yellow	May-July
Veratrum viride	White hellebore	3-6′	Yellowish green	May-July
Verbena hastata	Blue vervain	3-5′	Blue	June-Sept.

III. NATIVE VINES AND CLIMBING PLANTS

Vines and climbing plants are the material which nature uses to cover unsightly objects and to add graceful touches to natural plantations. They are admirably adapted to soften stiff architectural lines, affording a cover for the trunks of trees or intermingling with the shrubbery. They may be used to hide poles, fences, rubbish heaps, or anything of an unsightly nature, as well as to give pleasant shade to arbors, pergolas, and verandas. The woody climbers remain permanently on their supports from year to year; the herbaceous ones die to the ground annually.

WOODY VINES AND CLIMBERS

Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom.
T-D. *Ampelopsis arborea*	Pepper-vine	H-C.	Inconspicuous	June-July
T-D. *Ampelopsis cordata*	Simple-leaved ampelopsis	H-C.	Inconspicuous	May-June
T-D. *Ampelopsis quinquefolia*	Virginia creeper	H-C.	Inconspicuous	July
Tw. *Aristolochia macrophylla*	Dutchman's pipe	H-C.	Brownish	May-June
Tw. *Aristolochia tomentosa*	Woolly pipe-vine	H-C.	Brownish	May-June
Tw. *Berchemia scandens*	Supple-Jack	H-C.	Greenish white	March-May
T-D. *Bignonia capreolata*	Cross-vine	H-C.	Orange-yellow	April-May
Tw. *Calycocarpum Lyoni*	Cupseed	H-C.	Greenish	May-June
Tw. *Celastrus scandens*	Climbing bittersweet (fruit orange-red)	H-C.	Greenish	June
C. *Clematis crispa*	Marsh clematis	8-15′	Bluish purple	May-June
C. *Clematis ligusticifolia*	Western virgin's bower		White	June-Aug.
Tw. *Clematis Viorna*	Leather-flower	8-10′	Red	May-July
Tw. *Clematis virginiana*	Virginia virgin's bower	H-C.	White	July-Sept.

T. Attach themselves to a support by tendrils.

T-D. Form disks on their tendrils, by which they become attached to rough, flat surfaces, such as brick, rock, or the bark of trees.

Tw. Attach themselves by twining around a support.

C. Must be fastened by tying to a support, or they will simply trail over the surface of the ground.

H-C. High climbing.

	Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom.
Tw.	*Lathyrus myrtifolius*	Myrtle-leaved marsh pea	2-3′	Purple	May-July
Tw.	*Lathyrus palustris*	Marsh vetchling	2-3′	Purple	May-Aug.
Tw.	*Lonicera dioica*	Smooth-leaved honeysuckle	5-10′	Yellowish-purple	May-June
C.	*Lonicera flava*	Yellow honeysuckle	3-10′	Orange-yellow	April-May
Tw.	*Lonicera hirsuta*	Hairy honeysuckle	to 25′	Orange-yellow	June-July
Tw.	*Lonicera sempervirens*	Trumpet honeysuckle	8-16′	Scarlet or yellowish	April-Sept.
C.	*Lonicera Sullivantii*	Sullivant's honeysuckle	3-6′	Pale yellow	May-June
C.	*Lycium vulgare*	Matrimony vine (berries red)	to 20′	Purple	Summer
Tw.	*Menispermum canadense*	Canada moonseed	H-C.	Greenish white	June-July
C.	*Rosa setigera*	Prairie rose	to 15′	Rose	June-July
Tw.	*Smilax hispida*	Hispid greenbrier	H-C.	Greenish white	May-July
T-D.	*Tecoma radicans*	Trumpet creeper	H-C.	Scarlet	Aug.-Sept.
T.	*Vitis aestivalis*	Summer grape Downy grape	H-C.	Inconspicuous*	May-June
T.	*Vitis cinerea*	Frost grape Riverbank grape	H-C.	Inconspicuous*	May-June
T.	*Vitis cordifolia*	American wistaria	H-C.	Inconspicuous	May-June
T.	*Vitis vulpina*		H-C.	Inconspicuous*	May-June
Tw.	*Wistaria frutescens*		H-C.	Lilac-purple	April-June

HERBACEOUS VINES AND CLIMBERS

Tw.	*Apios tuberosa*	Ground-nut	10-15′	Purple	July-Sept.
Tw.	*Clematis Simsii*	Sim's clematis	H-C.	Purplish	May-Aug.
Tw.	*Convolvulus sepium*	Great bindweed	10-15′	Pinkish white	June-Aug.
Tw.	*Dioscorea villosa*	Wild yam-root	to 15′	Greenish yellow	June-July
Tw.	*Gonolobus caroliniensis*	Carolina gonolobus	to 15′	Brown-purple	May-July

*While the flowers of our native grapes are not very conspicuous, they fill the air with a delightful fragrance, and their numerous black or purple-black berries are very conspicuous in autumn.

Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
Tw. *Ipomoea pandurata*	Wild potato-vine	8-20′	White-purple striped	May-Sept.
Tw. *Passiflora lutea*	Yellow passion-flower	3-10′	Yellow	May-July
Tw. *Passiflora incarnata*	Passion-flower	10-30′	White with purple corolla	May-July
Tw. *Phaseolus polystachyus*	Wild bean	to 15′	Purple	July-Sept.
Tw. *Polygonum scandens*	Climbing false buckwheat	10-20′	Greenish white	Aug.-Sept.

NOTES

Mr. G. H. Pring, Horticulturist to the Garden, spoke before the Webster Groves High School, April 20, on "Spring Planting."

Dr. George T. Moore, Director of the Garden, attended the meetings of the American Philosophical Society at Philadelphia, April 24-25.

The October, 1919, number of the *Plant World* contains an article by B. M. Duggar, Physiologist to the Garden, on "Some Factors in Research."

Mr. L. P. Jensen, Arboriculturist to the Garden, gave a lantern-slide talk on "Landscape Gardening," April 16, before members of the Chapter House, Edwardsville, Ill.

Recent visitors to the Garden include Mr. W. H. E. Retzer, a former pupil in the School for Gardening; Mr. Alexander Lurie, formerly Horticulturist to the Garden; and Mr. C. R. Stillinger, of the White Pine Blister Rust Investigation, Spokane, Wash.

During the spring meeting of the American Chemical Society in St. Louis, April 13-16, one of the official excursions was to the Garden. The party was shown the greenhouses, as well as the library, and an hour or more was spent in a discussion of the research work in the laboratories.

Dr. B. M. Duggar, Physiologist to the Garden, presented a paper before the Division of Biological Chemistry of the American Chemical Society, April 14, on "The Effect of Conditions on the Relation of Seed Plants to H-Ion Concentration of Nutrient Solutions." Mr. W. H. Chambers, Rufus J. Lackland Fellow, followed Dr. Duggar with a paper on "The Relation of Dextrose to H-Ion Concentration with Bacillus Coli."

Among the chemists who made especial visits to the Garden during the meetings of the American Chemical Society were the following: Dr. E. C. Franklin, of Leland Stanford University; Dr. R. A. Gortner, of the University of Minnesota; Dr. G. H. A. Clewes, of Indianapolis; Dr. E. T. Wherry, of the Bureau of Chemistry, Washington, D. C.; Dr. F. K. Cameron, of the National Smelter Co., Salt Lake City; Dr. J. C. Oleson, of New York; and Dr. F. C. Baines, of the University of Kansas.

STATISTICAL INFORMATION FOR MARCH, 1920

GARDEN ATTENDANCE:

Total number of visitors	12,407

PLANT ACCESSIONS:

Total number of plants and seeds received as gifts	45
Total number of packets of seed received in exchange	94
Total number of plants received in exchange	8

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	66
Total number of books and pamphlets donated	128

HERBARIUM ACCESSIONS:

By Purchase—	
D. Lewis Dutton—Plants of Vermont	503
By Gift—	
S. H. Burnham—Species of *Hydnum*	8
Prof. W. C. Coker—Fungi of North Carolina	3
Mrs. Adele Lewis Grant—Specimens of *Mimulus* from California	11
C. G. Lloyd—*Stereum striatum* from Washington	1
Harold W. Pretz—*Trisetum spicatum* (L.) Richter from Pennsylvania	1
Dr. S. M. Zeller—Fungi of Corvallis, Oregon	12
Total	539

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2:00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

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THE TRUE MANGOSTEEN ATTACHED TO GARCINIA XANTHOCHYMUS.

METHOD OF INARCHING.

Missouri Botanical Garden Bulletin

Vol. VIII St. Louis, Mo., May, 1920 No. 5

GRAFTING THE MANGOSTEEN BY INARCHING

One of the most important methods of plant propagation is by grafting. Various methods have been devised, such as budding, whip graft, saddle graft, cleft graft, root graft, veneer graft, etc., to meet special requirements.

Budding.—The budding operation consists of inserting a detached bud underneath the bark of the stock at a time when the bark peels, usually during August or September. The buds are cut off to include a shield-shaped piece of the bark. In preparing the stock for the reception of the dormant bud a T-shaped incision is made through the bark, the crosswise cut being made first. The operator then opens the cut portion of the bark, pushes the bud within the cleft, and secures it with a raffia binding. After the union has taken place, which is usually in about two or three weeks, the raffia binding is removed so as not to restrict the swelling of the stock.

Grafting.—Grafting is accomplished by inserting a portion of a selected plant into another in order that it may obtain the vigor of the stock plant and produce flowers and fruit more abundantly. The operation is performed in the spring with dormant scions. It is employed especially for multiplying or perpetuating certain varieties of woody plants that do not reproduce from seeds or come true from seeds, as, for example, apples, pears, etc. It is one of the oldest arts of plant craft. Pliny describes a cleft graft, giving the precautions that the stock "must be that of a tree suitable for the purpose," and the graft must be "taken from one that is proper for grafting; the incision or cleft must not be made in a knot"; the graft must be from a tree that is "a good bearer and from a young shoot"; the graft must not be sharpened or pointed "while the wind is blowing."

Inarching.—Grafting by approach or inarching is the latest and most satisfactory method for perpetuating selected woody plants of tropical types. An important factor is that the operation may be performed almost any time during the grow-

ing period without losing either stock or scion, since the scion is not segregated from its roots until there is a perfect union.

The mangosteen is regarded by some as the most delicious of tropical fruits, and a special effort is being made to include this tree in the new tropical fruit collection now being established at the Garden. Its rooting system is extremely poor, especially during the seedling stage, which is the critical period. However, success has been attained by the method of inarching, using for stock plants the same genus, but a different species possessing a strong rooting system.

In 1913 plants of the mangosteen were imported from Ceylon for the large conservatories. Half of these were immediately set out in the economic house and the other half planted in pots and placed in the private growing houses. The attempt to grow these trees directly in the open ground upon their own roots was unsuccessful, but those which were carefully nursed in the private houses produced satisfactory growth. In 1915 seeds were obtained from India of a strong-rooting species, *Garcinia xanthochymus*, with the intention of trying it for a stock plant. These seed were given especial care and germinated shortly after. Recently the seedlings attained sufficient size to warrant attempting to graft the scions of the true mangosteen upon them.

The particular method of inarching depends upon whether both stock and scion are seedlings of equal size or whether one or the other must be taken from a larger specimen. In the experiments conducted at the Garden the true mangosteen scion is much the larger plant. Therefore the seedling stock plant had to be elevated to the height of the young scion, and the shoots chosen to be joined were those corresponding as nearly as possible in age, thickness, vigor of growth, etc. A thin slice approximately one-third the thickness of the stems was cut from both the scion and the stock in such a manner as to leave a perfectly even joint, the cut being made long enough to make a good strong union. The slicing or cutting of the outer layers should be accomplished as speedily as possible to prevent the sudden drying up of the exposed tissues. The cut areas of the two shoots are then brought as close together as possible, and securely bound with raffia. To further prevent any possibility of drying, the cut portions are covered with grafting wax. The plants are then placed in a Wardian case where all drafts are excluded, and care is taken to keep both the roots of stock and scion moist. Within three weeks a perfect union should be effected.

After the true mangosteen shoot has adhered to its foster parent it becomes necessary to sever it from the original plant, leaving only the grafted shoot of the true mangosteen,

Garcinia mangostana, upon the stem and roots of *Garcinia xanthochymus*. At least six to eight weeks should elapse before beginning the operation, and it should be accomplished gradually, otherwise a loss of the leaves and shrivelling of the entire shoot may result. The upper portion of the stock may be severed just as soon as the parts of the union are completely joined, thus permitting all the vigor of the well-rooted stock to pass into the newly grafted scion.

NATIVE PLANTS SUITABLE FOR THE GARDENS OF MISSOURI AND ADJOINING STATES

IV. NATIVE TREES AND SHRUBS WITH CONSPICUOUS FLOWERS

Following is a list of the trees and shrubs, conspicuous for their flowers, which will thrive in the section of the country surrounding the city of St. Louis. With the exception of a very few which have escaped from cultivation the species mentioned are all native of the eastern United States.

The greater part of those listed as small trees often assume the form of large shrubs, and may in most instances be used for either purpose. While most of the plants in the list will thrive in ordinary good loamy garden soil, some of them prefer special soil conditions, and for this reason a list of various soil conditions are given and indicated by numbers:

NATIVE TREES AND SHRUBS WITH CONSPICUOUS FLOWERS

Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
	LARGE TREES			
3**Aesculus glabra*	Ohio buckeye	30-50′	Yellow	April-May
3 *Aesculus octandra*	Yellow buckeye	60-80′	Yellow	April-May
3 *Catalpa bignonioides*	Indian bean	20-60′	White	June-July
3 *Catalpa speciosa*	Large Indian bean	40-100′	Whitish	May-June
3 *Cladrastis tinctoria*	Yellow-wood	20-30′	White	June

*Key to soil conditions:

1. Clay
2. Clay subsoil
3. Clay loam
4. Loam
5. Leafmold
6. Gravelly soil
7. Sandy loam
8. Disintegrated limestone
9. Disintegrated flint

Two or more numbers indicate a combination of soil conditions; for example, 2-4 is loam with a clay subsoil.

Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
3 *Crataegus cordata*	Washington thorn	20-30′	White	April-May
3 *Liriodendron tulipifera*	Tulip-tree	60-150′	Green-yellow, orange	May-June
3 *Magnolia acuminata*	Cucumber tree	40-80′	Greenish yellow	May-June
3 *Magnolia tripetala*	Umbrella tree	20-40′	White	May
3 *Prunus serotina*	Wild black cherry	30-60′	White	May
3 *Sassafras officinale*	Sassafras	30-80′	Yellow	April-May

SMALL TREES

3 *Amelanchier canadensis*	June-berry	10-30′	White	April-May
3 *Asimina triloba*	North American papaw	10-30′	Dark purple	April
3 *Bumelia lycioides*	Southern buckthorn	15-30′	White, greenish	June-Aug.
3-8 *Castanea pumila*	Chinquapin chestnut	10-30′	Greenish white	June
3 *Cercis canadensis*	Red-bud	15-25′	Pink-purple	March-April
3 *Chionanthus virginica*	Fringe-tree	15-25′	White	May-June
3 *Cornus florida*	Flowering dogwood	20-40′	White	April-May
3 *Crataegus coccinea*	Red haw	15-30′	White	April-May
3 *Crataegus Crus-galli*	Cockspur thorn	15-30′	White	May-June
3 *Crataegus macracantha*	Long-spined thorn	15-25′	White	May-June
3 *Crataegus mollis*	Red-fruited thorn	15-30′	White	April-May
3 *Crataegus punctata*	Large-fruited thorn	15-30′	White	May
3 *Halesia tetraptera*	Silver-bell	15-30′	White	April
3 *Magnolia glauca*	Sweet bay	15-25′	White	May-June
3 *Pyrus angustifolia*	Narrow-leaved crab-apple	15-20′	Pink	April-May
3 *Pyrus coronaria*	American crab-apple	15-25′	Rose	April-May
3 *Pyrus ioensis*	Western crab-apple	15-20′	Rose	April-May
3 *Oxydendrum arboreum*	Sorrel-tree	15-30′	White	July
3 *Prunus americana*	Wild red plum	15-25′	White	April
3 *Prunus pennsylvanica*	Wild red cherry	20-30′	White	April-May
3 *Rhus cotinoides*	American smoke tree	15-30′	Greenish	April-May
3 *Robinia viscosa*	Clammy locust	20-30′	Pinkish	June
3 *Viburnum Lentago*	Sheep-berry	10-20′	White	May
3 *Aesculus Pavia*	Red buckeye	6-10′	Red-purple	April-May
3 *Amelanchier Botryapium*	Shad-bush	8-15′	White	April-May

SHRUBS FOR MOIST AND SUNNY SITUATIONS

Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
3 *Amorpha fruticosa*	False indigo	5-15′	Violet-purple	May-July
3 *Aralia spinosa*	Hercules' club	15-20′	White	June
3 *Aronia arbutifolia*	Red chokeberry	6-10′	White, purplish	April-May
3 *Aronia nigra*	Black chokeberry	8-10′	White, purplish	April-May
3 *Baccharis halimifolia*	Groundsel tree	4-8′	White	Sept.-Oct.
3 *Berberis canadensis*	American barberry	4-6′	Yellow	May-June
3 *Calycanthus floridus*	Strawberry shrub	4-8′	Dark purple	April-Aug.
3 *Cephalanthus occidentalis*	Button-bush	8-12′	White	June-Sept.
3 *Cornus Amomum*	Silky cornel	5-15′	White	May-June
3 *Cornus Baileyi*	Bailey's cornel	3-10′	White	May-June
3 *Cornus candidissima*	Panicled dogwood	6-12′	White	May-June
3 *Cornus stolonifera*	Red osier dogwood	6-10′	White	May-June
3 *Cornus stricta*	Stiff dogwood	8-12′	White	April-May
3 *Cyrilla racemiflora*	Southern leatherwood	10-20′	White	May-July
3 *Elaeagnus argentea*	Silverberry	6-8′	Silvery yellow	April-May
3 *Elaeagnus canadensis*	Buffalo-berry	6-18′	Yellowish	April-May
6 *Hypericum Ascyron*	Giant St. John's-wort	2-5′	Yellow	July-Aug.
3 *Itea virginica*	Virginia willow	4-10′	White	May-June
3 *Lonicera ciliata*	Fly honeysuckle	3-6′	Yellowish white	May
3 *Lonicera caerulea*	Blue honeysuckle	3-6′	Bluish	June
3 *Lonicera Xylosteum*	Fly honeysuckle	3-7′	Yellowish white	May-June
7 *Myrica cerifera*	Wax myrtle	6-15′	White	March-April
3 *Philadelphus coronarius*	Mock orange	8-10′	White	May
3 *Philadelphus grandiflorus*	Large-flowered syringa	8-10′	White	May
3 *Philadelphus inodorus*	Odorless syringa	6-8′	White	May
3 *Physocarpus opulifolius*	Ninebark	6-10′	Pinkish white	June
3 *Prunus virginiana*	Choke cherry	3-10′	White	April
3 *Ribes aureum*	Missouri currant	6-10′	Yellow	April-May
3 *Rosa arkansana*	Arkansas rose	1-3′	Pink	June-July
2-3 *Rosa blanda*	Meadow rose	2-4′	Pink	June-July
3 *Rosa carolina*	Swamp rose	2-6′	Pink	June-Aug.
3 *Rosa nitida*	Northeastern rose	6″-2′	Pink	June-July

Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
3 *Rosa setigera*	Prairie rose	Bush 3-4′ Climbs to 15′	Rose	June-July
3 *Rosa Woodsii*	Wood's rose	1-3′	Pink	June-July
3 *Sambucus canadensis*	Common elder	6-10′	White	June-July
3 *Spiraea salicifolia*	Meadow-sweet	2-4′	White or pinkish	June-Aug.
3-8 *Spiraea tomentosa*	Steeple-bush	2-4′	Pink or purple	July-Sept.
3 *Staphylea trifolia*	Bladder-nut	6-15′	White	April-May
3 *Styrax americana*	Smooth storax	4-10′	White	March-April
3 *Styrax pulverulenta*	Downy storax	4-10′	White	March-April
3 *Viburnum alnifolium*	Hobble-bush	6-8′	White	May-June
8 *Viburnum cassinoides*	Withe-rod	4-10′	White	June-July
3 *Viburnum dentatum*	Arrow-wood	4-8′	White	May-June
3 *Viburnum molle*	Soft-leaved arrow-wood	4-8′	White	May-June
3 *Viburnum Opulus*	High-bush cranberry	8-10′	White	May-June

SHRUBS FOR MOIST, SHADY SITUATIONS

3 *Amelanchier rotundifolia*	June-berry	8-15′	White	April-May
4-5 *Azalea canescens*	Mountain azalea	4-12′	Rose to white	April-May
4-5 *Azalea lutea*	Flame azalea	4-15′	Orange-yellow or red	April-May
3 *Calycanthus laevigatus*	Smooth strawberry shrub	4-8′	Greenish purple	March-May
4 *Clethra alnifolia*	Sweet pepper-bush	3-5′	White	July-Aug.
3 *Cornus alternifolia*	Alternate-leaved dog-wood	8-20′	White	May-June
6 *Hamamelis virginiana*	Witch-hazel	6-8′	Yellow	Nov.-Dec.
8 *Lindera Benzoin*	Spice bush	4-15′	Yellow	March-May
3 *Styrax grandiflora*	Large-leaved storax	5-10′	White	March-May

SHRUBS FOR DRY AND SUNNY SITUATIONS

9 *Amorpha canescens*	Lead plant	1-3′	Bright blue	July-Aug.
3-8 *Bumelia lanuginosa*	Woolly buckthorn	6-20′	White	June-July
3-9 *Ceanothus americanus*	New Jersey tea	2-3′	White	May-June
3-9 *Ceanothus ovatus*	Small red-root	1-3′	White	May-June
3 *Diervilla trifida*	Bush honeysuckle	2-4′	Greenish white	May-June

Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
3 *Hydrangea arborescens*	Wild hydrangea	4-6′	White	July
3 *Hydrangea radiata*	Downy hydrangea	6-8′	White	June-July
6 *Hypericum densiflorum*	Dense-flowered St. John's-wort	3-5′	Yellow	July-Aug.
6 *Hypericum Kalmianum*	Kalm's St. John's-wort	1-2′	Yellow	August
6 *Hypericum prolificum*	Shrubby St. John's-wort	1-3′	Yellow	July-Sept.
8 *Rhamnus lanceolata*	Lance-leaved buck-thorn	8-20′	Greenish	May
3 *Robinia hispida*	Rose acacia	3-9′	Pink or purple	May-June
3-9 *Rosa humilis*	Pasture rose	1-2′	Pink	May-July
3 *Sambucus pubens*	Red-berried elder	3-8′	White	May
9 *Vaccinium corymbosum*	Tall blueberry	6-10′	White or pink	May-June
9 *Vaccinium vacillans*	Low blueberry	6″-4′	Pink	May-June
3-8 *Viburnum prunifolium*	Black haw	3-8′	White	April-May
3-8 *Viburnum rufidulum*	Southern black haw	6-15′	White	April-May

SHRUBS FOR DRY AND SHADY SITUATIONS

3 *Aesculus Arguta*	Western buckeye	3-10′	Yellow	March-April
3 *Amelanchier alnifolia*	Service berry	6-8′	White	April
3 *Azalea nudiflora*	Pink azalea	2-6′	Pink	April-May
3 *Cornus circinata*	Round-leaved dogwood	3-8′	White	May-June
3-8 *Rhus aromatica*	Fragrant sumac	3-10′	Yellow	March-April
3-8 *Rhus trilobata*	Ill-scented sumac	2-6′	Yellow	March-April

NOTES

The annual flower sermon, provided for in Mr. Shaw's will, was preached at Christ Church Cathedral, May 16, by the Rev. S. N. Watson, Rector Emeritus of the Church of the Holy Trinity, Paris, France.

Recent visitors to the Garden include Dr. D. T. MacDougal, Director Botanical Research, Carnegie Institution of Washington, Desert Laboratory, Tucson, Ariz.; Prof. W. E. Ritter, Director of Scripps Biological Research Institute, La Jolla, Cal.; Mr. L. W. Durrell, Pathologist at the Missouri Fruit Experiment Station, Mountain Grove, Mo.

Mr. H. H McKinney, Cereal Pathologist, United States Department of Agriculture, who is working on the new wheat disease prevalent in the Illinois bottoms, spent a couple of days at the Garden recently

The annual report of the director of the department of botanical research, Carnegie Institution of Washington, contains three short reports by Dr. B. M. Duggar, Physiologist to the Garden, covering the work done by him at the Coastal Laboratory, Carmel, Cal.

STATISTICAL INFORMATION FOR APRIL, 1920

GARDEN ATTENDANCE:

Total number of visitors.....14,413

PLANT ACCESSIONS:

Total number of packets of seed received in exchange.. 282
Total number of plants received in exchange..... 865

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought..... 20
Total number of books and pamphlets donated..... 238

HERBARIUM ACCESSIONS:

By Gift—
Prof. E. Bethel—Specimens of *Lesquerella* and *Physaria* from Colorado 6
Ira W. Clokey—Fragment of type of *Dithyrea clinata* Macbride & Payson..... 1
Mrs. Adele Lewis Grant—*Mimulus* from California... 16
M. M. High—Plants of Texas..... 60
C. G. Lloyd—*Stereum occidentale* Lloyd, and *Polyporus* sp. 2

Prof. Aven Nelson—Specimens of *Lesquerella* from Utah 2
Dr. L. O. Overholts—*Stereum rugisporum* from Colorado 1
Prof. C. V. Piper—Specimens of *Senecio* from Mt. Rainier, Washington 4
University of Wisconsin—Fungi of Wisconsin..... 10

By Exchange—
Bureau of Science, Manila, P. I.—Fungi of the Philippine Islands 153

Total..... 255

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2:00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

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W. F. LANGAN,
Engineer.

H. VALLENTINE,
Construction.

Missouri Botanical Garden Bulletin

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OF THE MISSOURI BOTANICAL GARDEN

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Missouri Botanical Garden Bulletin

Vol. VIII St. Louis, Mo., June, 1920 No. 6

NATIVE PLANTS SUITABLE FOR THE GARDENS OF MISSOURI AND ADJOINING STATES

V. NATIVE PERENNIALS FOR THE HARDY BORDER

With the exception of *Cassia nictitans*, which reseeds itself every year, these plants are perfectly hardy and will do well in the border if given ordinary culture, particularly if some attention is given to obtaining as nearly as possible the natural conditions. Those marked (x) are not native, but have been introduced or escaped from cultivation and have established themselves so generally as to appear indigenous in many places.

Our native hardy perennials are not as well known, nor as extensively used, in our gardens as they should be, and it is hoped that this list will be the means of bringing them into more general use. Succession of bloom may be had from the earliest spring until the ground freezes, and many pleasing combinations of color and arrangements may be obtained by intelligent use of these plants.

NATIVE PERENNIALS FOR THE HARDY BORDER

Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
PLANTS GROWING IN DRY, SUNNY SITUATIONS.				
*3 *Achillea Millefolium.*	Yarrow	1-2′	White	June-Nov.
8 *Agave virginica*	False aloe	3-6′	Greenish yellow	June-July
3-8 *Allium stellatum*	Prairie wild onion	6-18″	Rose	July-Sept.
3-8 *Asclepias tuberosa*	Butterfly weed.	1-2′	Orange	June-Aug.
3 *Aster anomalus*	Many-rayed aster	1-3′	Blue	Sept.-Oct.
3 *Aster azureus*	Sky-blue aster.	2-4′	Bright blue	Aug.-Oct.
3-9 *Aster Drummondii*	Drummond's aster	1-4′	Blue	Sept.-Oct.
3 *Aster grandiflorus*	Large-flowered aster	1-3′	Violet	Sept.-Oct.

	Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
3-9	*Aster multiflorus*	White wreath aster	1-3′	White	Aug.-Oct.
8	*Aster oblongifolius*	Aromatic aster.	1-2′	Pinkish-purple	Aug.-Oct.
3-9	*Aster patens*	Late purple aster	1-3′	Purple	Aug.-Oct.
3-8	*Aster sagittifolius*	Arrow-leaved aster	2-4′	Blue	Aug.-Oct.
3	*Aster spectabilis*	Low showy aster	1-2′	Violet	Aug.-Oct.
3	*Aster turbinellus*	Prairie aster	2-3′	Violet	Sept.-Oct.
3	*Astragalus crassicarpus*	Ground plum (trailing)	6-15″	Violet-purple	April-June
2-3	*Astragalus distortus*	Bent milk vetch	8-15″	Purple	March-July
3	*Baptisia tinctoria*	Wild indigo	2-4′	Yellow	June-Sept.
(x)3	*Belamcanda chinensis*	Blackberry lily	2-3′	Crimson-purple	June-July
3-8	*Cassia nictitans*	Sensitive pea (annual)	6-15″	Yellow	July-Oct.
(x)3	*Chrysanthemum Leucanthemum*	Ox-eye daisy	1-2′	White	May-Aug.
3-7	*Chrysopsis hispida*	Hispid golden aster	6-12″	Yellow	July-Sept.
3-7	*Chrysopsis villosa*	Hairy golden aster	1-2′	Yellow	July-Aug.
3-8	*Clematis Fremontii*	Fremont's clematis	6-15″	Purple	April-May
3	*Coreopsis lanceolata*	Lance-leaved tickseed	1-2′	Yellow	May-Aug.
3	*Delphinium exaltatum*	Tall larkspur	3-4′	Blue	June-July
3	*Desmodium canadense*	Canadian tick trefoil	2-6′	Purple	July-Sept.
8	*Echinacea angustifolia*	Pale purple cone-flower	1-3′	Purple	July-Oct.
3	*Eryngium Leavenworthii*	Leavenworth's eryngo	1-3′	Bluish	July-Oct.
3-8	*Erysimum asperum*	Western wall-flower	1-3′	Orange-yellow	May-July

*Key to soil conditions:

Two or more numbers indicate a combination of soil conditions; for example, 2-4 is loam with a clay subsoil.

1. Clay.
2. Clay subsoil.
3. Clay loam.
4. Loam.
5. Leafmold.
6. Gravelly soil.
7. Sandy loam.
8. Disintegrated limestone.
9. Disintegrated flint.

	Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
3	*Euphorbia corollata*	Flowering spurge	1-3′	White	May-Oct.
3	*Gaillardia aristata*	Great-flowered gaillardia	1-3′	Yellow	May-Sept.
3	*Gaura coccinea*	Scarlet gaura	6″-2′	Red turning scarlet	May-Aug.
3	*Geum ciliatum*	Purple avens	6″-2′	Yellow	May-July
3	*Grindelia lanceolata*	Narrow-leaved gum-plant	1-2′	Yellow	July-Sept.
3	*Grindelia squarrosa*	Broad-leaved gum-plant	1-2′	Yellow	June-Sept.
3-8	*Helianthus hirsutus*	Stiff-haired sunflower	2-4′	Yellow	July-Oct.
3	*Helianthus laetiflorus*	Showy sunflower	3-5′	Yellow	Aug.-Sept.
3	*Helianthus mollis*	Hairy sunflower	2-4′	Yellow	Aug.-Sept.
9	*Helianthus occidentalis*	Few-leaved sunflower	2-3′	Yellow	Aug.-Sept.
3	*Helianthus orgyalis*	Linear-leaved sunflower	3-6′	Yellow	Sept.-Oct.
8	*Heliopsis helianthoides*	False sunflower.	2-4′	Yellow	July-Sept.
8	*Heliopsis scabra*	Rough heliopsis	2-4′	Yellow	June-Sept.
3-8	*Heuchera americana*	Alum-root	2-3′	Greenish white	May-Aug.
3-8	*Heuchera hispida*	Rough heuchera	2-4′	Greenish white	May-June
3-8	*Heuchera Rugelii*	Rugel's heuchera	6-24″	Greenish white	July-Sept.
3	*Liatris cylindracea*	Cylindric blazing-star	1-2′	Purple	July-Sept.
3	*Liatris elegans*	Handsome blazing-star	1-5′	Rose	Aug.-Oct.
3-8	*Liatris graminifolia*	Loose-flowered button snake-root	1-3′	Purple	Aug.-Sept.
3-8	*Liatris punctata*	Dotted button snakeroot	1-2′	Purple	Aug.-Oct.
3-8	*Liatris pycnostachya*	Hairy button snakeroot	2-4′	Purple	Aug.-Sept.
3-8	*Liatris scariosa*	Large button snakeroot	3-5′	Purple	Aug.-Sept.
3-8	*Liatris squarrosa*	Blazing-star	1-3′	Purple	June-Sept.
(x)3	*Linaria vulgaris*	Butter and eggs	1-2′	Yellow and white	June-Sept.
8	*Lepachys pinnata*	Gray-headed cone-flower	2-4′	Yellow	June-Sept.
7	*Lespedeza procumbens*	Trailing bush-clover (low trailing)		Violet-purple	Aug.-Sept.
7	*Lespedeza violacea*	Bush-clover	1-3′	Violet-purple	Aug.-Sept.
3	*Lysimachia punctata*	Spotted loose-strife	2-3′	Yellow	June-July

	Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
(x)3	*Lysimachia vulgaris*	Golden loose-strife	2-3′	Yellow	June-Aug.
3	*Monarda fistulosa*	Wild bergamot.	2-4′	Pink	June-Sept.
(x)3	*Nepeta hederacea*	Ground ivy (low, trailing)		Blue	April-May
3	*Oenothera fruticosa*	Common sundrop	1-3′	Yellow	June-Aug.
3-8	*Oenothera missouriensis*	Missouri prim-rose (tufted).	1-2′	Yellow	May-July
3	*Parthenium integrifolium*	American feverfew	2-3′	White	May-Sept.
8	*Parthenium repens*	Creeping parthenium	1-2′	White	May-July
3	*Pentstemon grandiflorus*	I arge-flowered beard-tongue	1-3′	Lavender blue	June-Aug.
3-8	*Pentstemon hirsutus*	Hairy beard-tongue	1-2′	White	July-Sept.
8	*Petalostemum candidum*	White prairie-clover	1-2′	White	July-Aug.
8	*Petalostemum purpureum*	Violet prairie-clover	2-3′	Violet-purple	July-Aug.
3	*Petalostemum tenuifolium*	Silky prairie-clover	1-2′	Rose-purple	July-Aug.
3	*Phlox amoena*	Hairy phlox	6-18″	Pink	April-June
3	*Phlox paniculata*	Garden phlox	1-3′	Pink or white	July-Sept.
3-8	*Phlox pilosa*	Downy phlox	6-12″	Pink or white	April-June
3	*Phlox subulata*	Moss pink	4-6″	Pink, purple, or white	April-June
3	*Potentilla argentea*	Silvery cinquefoil (trailing)		Yellow	May-Sept.
3	*Potentilla canadensis*	Five-finger (trailing)		Yellow	April-Aug.
3	*Potentilla candicans*	Low cinquefoil (tufted)	1-2′	Yellow	Summer
8	*Psoralea floribunda*	Many-flowered psoralea	1-4′	Purplish	May-Oct.
7	*Psoralea pedunculata*	Samson's snake-root	1-3′	Purplish	March-July
8	*Rudbeckia fulgida*	Orange cone-flower	1-2′	Orange	Aug.-Sept.
3	*Salvia azurea* var. *grandiflora*	Blue sage	2-5′	Blue	July-Sept.
3	*Sanguisorba minor*	Salad burnet	10-20″	Greenish	Summer
(x)3	*Saponaria officinalis*	Bouncing Bet	1-2′	Pink	Summer
3-8	*Schrankia uncinata*	Sensitive brier (trailing)	2-4′	Pink	May-July
3	*Sedum Telephium*	Orpine	1′	Purple	June-Sept.
3-8	*Silene regia*	Royal catchfly.	3-4′	Scarlet	July
3	*Silphium integrifolium*	Entire-leaved rosin-weed	2-5′	Yellow	Aug.-Sept.
3-7	*Solanum elaeagnifolium*	Silver-leaved nightshade	1-3′	Blue	May-Sept.
3	*Solidago canadensis*	Canada golden-rod	3-6′	Yellow	Aug.-Nov.

	Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
3	*Solidago nemoralis*	Field goldenrod	1-2′	Yellow	July-Oct.
9	*Solidago petiolaris*	Downy goldenrod	2-4′	Yellow	Sept.-Oct.
3	*Solidago Purshii*	River-bank goldenrod	6-18″	Yellow	July-Sept.
3	*Solidago radula*	Rough goldenrod	1-3′	Yellow	Aug.-Sept.
3-8	*Solidago rigida*	Hard-leaved goldenrod	1-4′	Yellow	Aug.-Oct.
3	*Solidago rugosa*	Tall hairy goldenrod	3-6′	Yellow	July-Nov.
3	*Solidago squarrosa*	Stout goldenrod	2-4′	Yellow	Aug.-Oct.
3-8	*Solidago ulmifolia*	Elm-leaved goldenrod	2-4′	Yellow	July-Sept.
3	*Tradescantia brevicaulis*	Short-stemmed spiderwort	6-12″	Rose-purple	April-May
3	*Tradescantia rosea*	Roseate spiderwort	6-12″	Rose	April-Aug.
3-8	*Triosteum angustifolium*	Horse gentian.	1-2′	Reddish	May-June
3-8	*Verbena canadensis*	Large-flowered verbena	8-15″	Blue	April-July
8	*Verbesina helianthoides*	Sunflower crownbeard	2-4′	Yellow	June-July
8	*Verbesina virginica*	Virginia crownbeard	3-6′	White	Aug.-Sept.
3	*Vernonia Baldwinii*	Baldwin's ironweed	2-4′	Purple	July-Sept.
3	*Vernonia crinita*	Great ironweed	3-6′	Purple	Aug.-Oct.
3	*Viola palmata*	Early blue violet (tufted)	6″	Blue	March-May
3	*Yucca angustifolia*	Bear-grass	2-4′	White	June-July
3	*Yucca filamentosa*	Adam's needle.	2-4′	White	June-July

PLANTS GROWING IN DRY, PARTIALLY SHADED SITUATIONS

8	*Aster laevis*	Smooth aster	2-4′	Violet or blue	Sept.-Oct
3	*Cimicifuga racemosa*	Black snakeroot	3-6′	White	June-Aug.
3	*Coreopsis pubescens*	Star tickseed	1-3′	Yellow	June-Aug.
3	*Eupatorium aromaticum*	Smaller white snakeroot	1-2′	White	Aug.-Oct.
3	*Galium concinnum*	Shining bedstraw	4-8″	White	June-Aug.
3	*Gillenia stipulacea*	American ipecac	2-3′	Pinkish white	June-July
3	*Gillenia trifoliata*	Indian physic	1-2′	Pinkish white	May-July
3-8	*Helianthus divaricatus*	Rough or woodland sunflower	3-5′	Yellow	July-Sept.
3	*Iris cristata*	Crested dwarf iris	2-6″	Blue	April-May

	Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
3	*Iris verna*	Dwarf iris	3-8″	Blue	April-May
(x)3	*Lychnis chalcedonica*	Scarlet lychnis	1-2½′	Scarlet	June-Sept.
3	*Phlox maculata*	Wild Sweet-William	6-18″	Pink	June-July
3	*Scutellaria cordifolia*	Heart-leaved skullcap	1-3′	Blue	June-Aug.
3	*Silene caroliniana*	Wild pink (tufted)	4-10″	Scarlet	April-June
3-8	*Silene stellata*	Starry campion	2-3½′	White	June-Aug.
3	*Solidago odora*	Sweet-scented golden-rod	1-3′	Yellow	July-Sept.
3	*Thalictrum dioicum*	Early meadow rue	1-2′	Greenish	April-May
3	*Thalictrum polygamum*	Tall meadow rue	3-8′	White	July-Sept.
3	*Thalictrum purpurascens*	Purplish meadow rue	4-7′	Purple	June-Aug.
3	*Waldsteinia fragaroides*	Barren strawberry (creeping)		Yellow	May-June

PLANTS GROWING IN MOIST, SUNNY SITUATIONS

3	*Achillea Ptarmica*	Sneezeweed	1-2′	White	July-Sept.
3	*Allium Schoenoprasum*	Chives	10-18″	Blue	June-July
6	*Ascyrum stans*	St. Peter's-wort	1-2′	Yellow	July-Aug.
3	*Aster amethystinus*	Amethyst aster	2-4′	Purple	Sept.-Oct.
3	*Aster novae-angliae*	New England aster	3-6′	Violet-purple	Aug.-Oct.
3	*Aster novi-belgii*	New York aster	1-3′	Violet	Aug.-Oct.
3	*Aster paniculatus*	Tall white or panicled aster	3-5′	White	Aug.-Oct.
3	*Aster salicifolius*	Willow-leaved aster	2-4′	White	Aug.-Oct.
3	*Baptisia alba*	White wild indigo	1-3′	White	May-June
3	*Baptisia australis*	Blue false indigo	2-3′	Indigo-blue	June-Aug.
2-3	*Baptisia leucantha*	Large white wild indigo	2-4′	White	June-July
3	*Boltonia asteroides*	Aster-like boltonia	3-6′	Pinkish white	July-Sept.
3	*Boltonia decurrens*	Clasping-leaved boltonia	3-6′	Purple	Aug.-Sept.
3	*Boltonia diffusa*	Panicled boltonia	3-5′	White	Aug.-Oct.
3	*Boltonia latisquama*	Broad-scaled boltonia	3-6′	Violet-blue	July-Sept.
3	*Campanula rotundifolia*	Blue bells of Scotland	6-18″	Blue	June-Sept.
3	*Cassia marylandica*	Wild senna	2-4′	Yellow	July-Aug.
3	*Chelone glabra*	Turtle-head	1-3′	Pinkish white	July-Sept.

	Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
(x)3	*Cleome spinosa*	Spider flower	2-4′	Purple or whitish	Summer
3	*Collinsonia canadensis*	Horse-balm	1-3′	Lemon-yellow	May-June
3	*Convallaria majalis*	Lily-of-the-valley	6-8″	White	April-May
3	*Coreopsis grandiflora*	Large-flowered tickseed	1-3′	Yellow	May-Aug.
3	*Coreopsis tripteris*	Tall tickseed	3-6′	Yellow	July-Oct.
(x)3	*Dianthus deltoides*	Maiden pink (tufted)	6-10″	Pink	Summer
8	*Echinacea purpurea*	Purple cone-flower	2-4′	Purple	July-Oct.
3	*Eryngium yuccifolium*	Button snake-root	2-6′	Bluish	June-Sept.
3	*Filipendula rubra*	Queen-of-the-prairie	2-4′	Pink or purple	June-July
3	*Helenium autumnale*	Sneezeweed	2-3′	Yellow	Aug.-Oct.
3	*Helenium nudiflorum*	Purple-head sneezeweed	1-3′	Yellow	June-Oct.
3	*Helianthus angustifolius*	Narrow-leaved sunflower	3-6′	Bright yellow	Aug.-Oct.
3	*Helianthus decapitatus*	Thin-leaved sunflower	3-5′	Yellow	Aug.-Sept.
3	*Helianthus grosseserratus*	Saw-tooth sunflower	4-10′	Yellow	Aug.-Oct.
(x)3	*Hemerocallis fulva*	Day-lily	2-3′	Orange	June-July
3	*Hesperis matronalis*	Dame's violet	2-3′	Pink, purple, or white	May-Aug.
3-8	*Heuchera pubescens*	Downy heuchera	1-3′	Greenish white	May-June
3	*Hibiscus lasiocarpus*	Hairy-fruited rose-mallow	4-5′	Pink or white	Aug.
3	*Hibiscus Moscheutos*	Swamp rose-mallow	4-5′	Pink or white	Aug.-Sept.
7	*Krigia Dandelion*	Goat's-beard	6-12″	Yellow	April-June
3	*Lilium superbum*	Turk's-cap lily	3-5′	Orange-red	June-July
3	*Lysimachia Nummularia*	Moneywort (low, creeping)		Yellow	June-Aug.
3	*Lythrum Salicaria*	Purple loose-strife	2-3′	Purple	June-Aug.
3	*Malva rotundifolia*	Dwarf, running mallow (procumbent)		Blue	May-Nov.
3	*Monarda Bradburiana*	Bradbury's monarda	1-2′	Purple	May-July
3	*Monarda didyma*	Oswego tea	2-3′	Scarlet	July-Sept.
3	*Pentstemon glaber*	Large smooth beard-tongue	1-2′	Blue	May-Aug.
3	*Pentstemon gracilis*	Slender beard-tongue	6-15″	Purple	May-July
3	*Phalaris arundinacea*	Reed canary grass	2-4′		July-Aug.
3	*Physostegia virginiana*	False dragon-head	2-3′	Rose	July-Sept.

	Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
3	*Pycnanthemum linifolium*	Narrow-leaved mountain-mint	1-2½′	White	July-Sept.
3	*Rudbeckia laciniata*	Tall cone-flower	3-8′	Yellow	July-Sept.
3	*Rudbeckia speciosa*	Showy cone-flower	1-3′	Yellow	Aug.-Oct.
3	*Ruellia strepens*	Smooth ruellia.	1-3′	Blue	May-July
3	*Sedum pulchellum*	Widow's cross (trailing)		Rose-purple	May-July
3	*Solidago sempervirens*	Seaside golden-rod	3-5′	Yellow	Aug.-Dec.
3	*Solidago serotina*	Late golden-rod	3-6′	Yellow	Aug.-Oct.
3	*Thermopsis mollis*	Allegheny thermopsis	2-3′	Yellow	July-Aug.
3	*Thermopsis rhombifolia*	Prairie thermopsis	8-20″	Yellow	June-July
3	*Tiarella cordifolia*	False mitrewort	6-12″	White	April-May
3	*Tradescantia virginiana*	Spiderwort	1-3′	Blue	May-Aug.
3	*Uniola latifolia*	Spike grass	2-4′		Aug.-Sept.
6	*Vernonia fasciculata*	Western iron-weed	2-4′	Purple	July-Sept.
3	*Viola striata*	Pale or striped violet	6-12″	Cream, white	April-June

PLANTS GROWING IN MOIST, PARTIALLY SHADED SITUATIONS

3	*Astragalus carolinianus*	Carolina milk vetch	1-4′	Greenish yellow	July-Aug.
3	*Aster cordifolius*	Blue wood aster	1-4′	Blue	Sept.-Nov.
3	*Aster laterifolius*	Calico aster	1-4′	White	Aug.-Oct.
3	*Commelina hirtella*	Bearded day-flower	1-2′	Blue	Aug.-Oct.
3	*Commelina nudiflora*	Creeping day-flower	1-2′	Blue	July-Oct.
3	*Commelina virginica*	Virginia day-flower	1-3′	Blue	June-Sept.
3-5	*Dicentra eximia*	Wild bleeding-heart	6-12″	Pink	May-Sept.
3-5	*Erythronium americanum*	Yellow adder's-tongue	6-12″	Yellow	March-May
3-8	*Eupatorium ageratifolium*	White snake-root	1-3′	White	July-Oct.
3	*Eupatorium coelestinum*	Mist-flower	1-2′	Blue	Aug.-Oct.
3	*Epilobium hirsutum*	Great hairy willow herb	2-4′	Rose-purple	June-Sept.
5	*Geranium maculatum*	Wild crane's bill	1-2′	Rose-purple	April-June

Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
7 *Krigia virginica*	Carolina dwarf dandelion	1-2′	Yellow	May-Oct.
3 *Lysimachia quadrifolia*	Loosestrife	1-3′	Yellow	June-Aug.
3 *Meibomia Dillenii*	Dillen's tick trefoil	2-3′	Purple	June-Sept.
3 *Pentstemon Digitalis*	Foxglove beard-tongue	1-3′	White	May-July
3 *Pentstemon laevigatus*	Smooth beard-tongue	1-3′	Purplish	May-July
3 *Phlox glaberrima*	Smooth phlox	1-2′	Pink	May-July
3 *Rudbeckia subtomentosa*	Sweet cone-flower	2-4′	Yellow	July-Sept.

NOTES

Dr. B. M. Duggar, Physiologist to the Garden, will spend the summer in scientific work at the Coastal Laboratory of Carnegie Institution of Washington, Carmel, California.

Dr. George T. Moore, Director of the Garden, attended the meetings of the Garden Club of America, June 28-July 1, at Manchester, Massachusetts.

Mr. Emil Hansen, landscape gardener, Utah Agricultural Experiment Station, visited the Garden recently.

Mr. G. H. Pring, Horticulturist to the Garden, will spend a part of the summer teaching horticulture at the Cleveland Normal School, Cleveland, Ohio.

At the commencement of Washington University, June 11, degrees were conferred upon members of the graduate laboratory, as follows: Doctor of Philosophy, W. H. Chambers, Joanne L. Karrer, Takashi Matsumoto; Master of Arts, Edwin B. Payson.

The Rufus J. Lackland fellowships for the year 1920-21 have been awarded as follows:

Mr. G. M. Armstrong, B. S. Clemson College, M. A. University of Wisconsin, reappointed second year.

Mr. F. S. Wolpert, A. B. University of Montana, reappointed second year.

Mr. R. W. Webb, B. S. Clemson College, M. A. Washington University, reappointed third year.

Other appointments were as follows:

Dr. Joanne L. Karrer, B. S. and M. S. University of Washington, Ph.D. Washington University, appointed Research Assistant to the Missouri Botanical Garden and Teaching Fellow, Henry Shaw School of Botany of Washington University.

Mrs. Adele Lewis Grant, B. S. University of California, M. A. Washington University, Teaching Fellow in the Henry Shaw School of Botany, 1918-1920, appointed Jessie R. Barr Fellow.

Mr. H. L. Roberts, B. S. Knox College, Teaching Fellow, Henry Shaw School of Botany.

The following is a list of birds, comprising 72 varieties, seen in the Missouri Botanical Garden from March 10 to June 29:

Red-winged blackbird
Blue bird
Bob-white
Cardinal
Catbird
Cedar waxwing
Chewink
Chickadee
Brown creeper
Cowbird
Crow
Black-billed cuckoo
Flicker
Crested flycatcher
Blue-gray gnatcatcher
Goldfinch
Grackle
Rose-breasted grosbeak
Night hawk
Sparrow hawk
Blue heron
Humming-bird
Indigo bunting
Blue jay
Junco
Kingbird
Belted kingfisher
Golden-crowned kinglet
Ruby-crowned kinglet
Meadow-lark
Purple martin
White-breasted nuthatch
Baltimore golden oriole
Orchard oriole
Wood pewee
Wilson's phalarope
Red poll
Redstart
Robin
Spotted sandpiper
Siskin
Wilson's snipe
Chipping sparrow
Field sparrow
Song sparrow
White-crowned sparrow
White-throated sparrow
Bank swallow
Barn swallow
Tree swallow
Brown thrasher
Hermit thrush
Olive-backed thrush
Red-breasted thrush
Wood thrush
Tufted titmouse
Red-eyed vireo
Warbling vireo
Blackburnian warbler
Black-throated warbler
Chestnut-sided warbler
Magnolia warbler
Maryland yellow-throated warbler
Myrtle warbler
Wilson warbler
Yellow warbler
Carolina wren
House wren
Marsh wren
Downy woodpecker
Hairy woodpecker
Red-headed woodpecker

STATISTICAL INFORMATION FOR MAY, 1920

GARDEN ATTENDANCE:

Total number of visitors.....24,787

PLANT ACCESSIONS:

Total number of plants and seeds received as gifts..... 1,047
Total number of packets of seed received in exchange... 72
Total number of plants received in exchange..... 35

PLANT DISTRIBUTION:

Total number of plants distributed in exchange..... 33

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought..... 30
Total number of books and pamphlets donated..... 114

HERBARIUM ACCESSIONS:

By Purchase—
Th. Oswald Weigel—Plants of the Philippine Islands collected by Father Morice Vanoverbergh..... 122
D. Lewis Dutton—Plants of Florida and Vermont..... 385

By Gift—
A. O. Garrett—*Lesquerella* sp..... 1
C. G. Lloyd—Hyphomycetous fungus..... 1
Miss Martha H. Montgomery—Plants of Illinois..... 2
D. C. Neal—Fungus on bark..... 1
W. H. Snell—Specimens of *Peniophora* sp. causing timber rot 2

By Exchange—
California Academy of Sciences—*Senecio salignus* DC. from Arizona..... 1
Doctor Rudolf Schlechter—Types of orchids from South Africa 7

Total 522

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2:00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

Director,
GEORGE T. MOORE.

BENJAMIN MINGE DUGGAR,
Physiologist in charge of Graduate Laboratory.

JESSE M. GREENMAN,
Curator of Herbarium.

HERMANN VON SCHRENK,
Pathologist.

ROBERT W. WEBB,
Research Assistant.

EDWARD A. BURT,
Mycologist and Librarian.

KATHERINE H. LEIGH,
Secretary to the Director.

NELL C. HORNER,
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G. H. PRING,
Horticulturist.

JOHN NOYES,
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PAUL A. KOHL,
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P. C. BRAWNER,
Painter.

W. F. LANGAN,
Engineer.

H. VALLENTINE,
Construction.

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. VIII SEPTEMBER, 1920 No. 7

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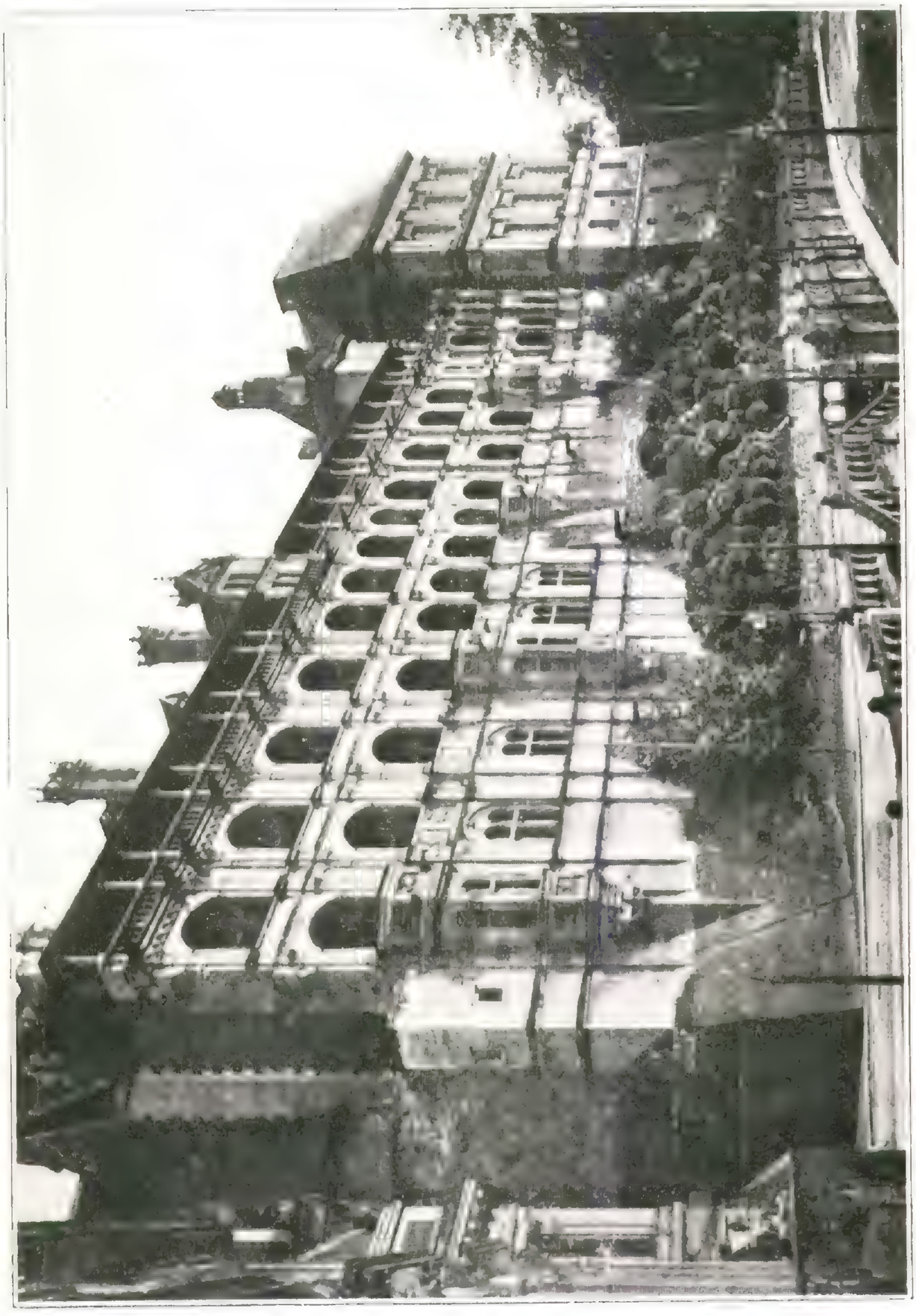


NORTH FAÇADE OF CHATEAU OF BLOIS.

Missouri Botanical Garden Bulletin

Vol. VIII St. Louis, Mo., September, 1920 No. 7

FRENCH CHATEAU GARDENS IN POST-WAR PERIOD

When the subject of chateau gardens of France is mentioned, places such as Versailles, Fontainebleau, Chantilly, St. Cloud, and St. Germain suggest themselves, they being some of the finest examples of the French school of landscape gardening. While touching upon some of these gardens, the purpose of this article is to dwell more on the smaller places, especially those in the Touraine Valley.

The climax of garden-making in France was reached when Le Nôtre, the celebrated French landscape architect, developed and completed the gardens of Versailles. Gardens one can hardly call them, however, for they are so vast that their magnitude alone would serve to make them extremely interesting. The innumerable lead vases, the many statues, fountains, and smaller gardens give the park of Versailles a charm not to be equalled elsewhere. None of the gardens were used for war purposes, but a portion of the park remote from the chateau was devoted in 1918 and 1919 by the Garden Service of the United States Quartermaster Corps to the growing of vegetables for the American Expeditionary Forces. In the spring and summer of 1919 the park undoubtedly was in as good a condition as at any time, and fortunate were the many members of the American Expeditionary Forces who journeyed from Paris to view that marvelous chateau and park.

Fontainebleau, that beautiful palace built by Francis I, with its wonderful forests and gardens, was in fine condition, except that the bedding plants, so essential to carry out the scheme of the parterres, were lacking.

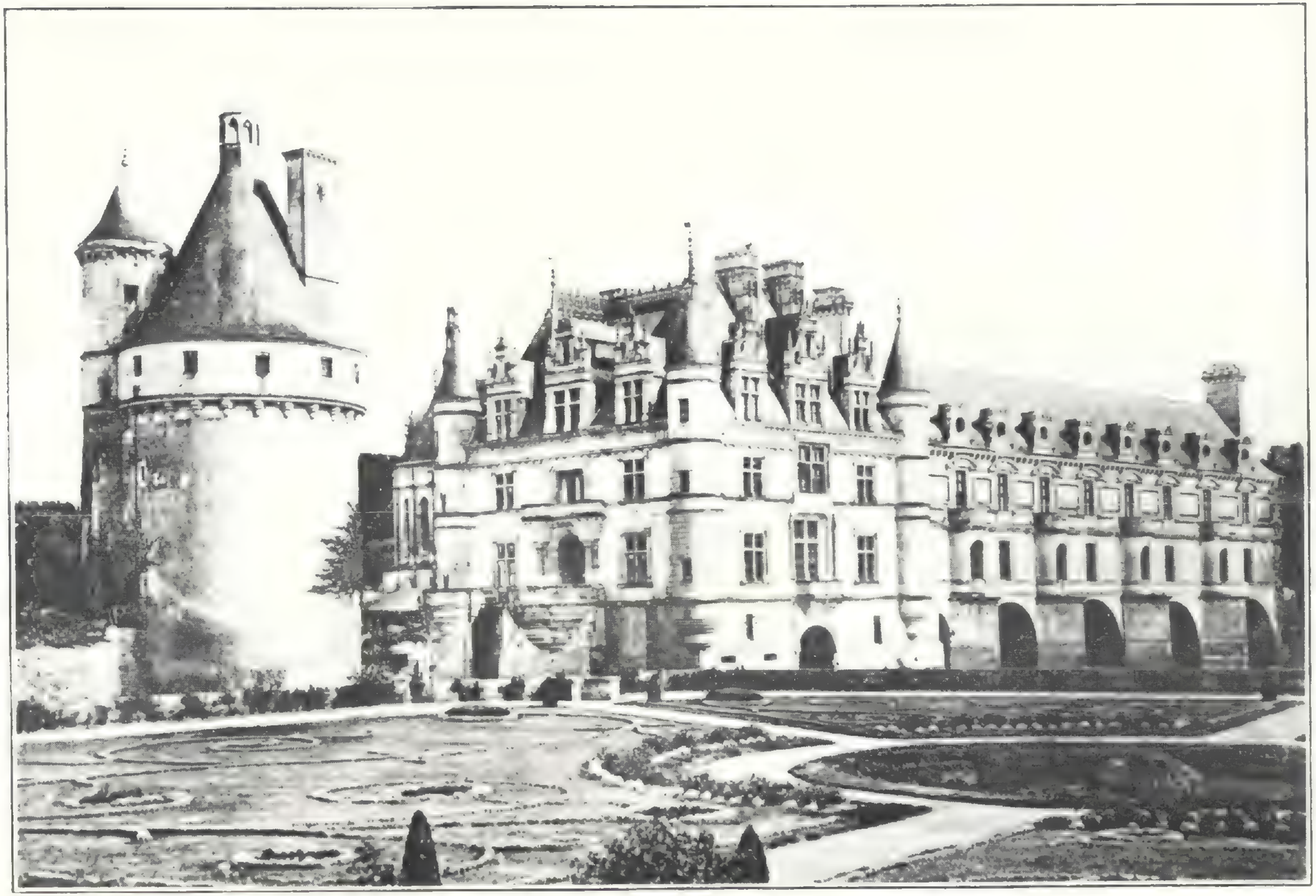
A visit to Paris was necessary to see French gardens at their best in 1919. The garden of the Luxembourg, the only remaining Renaissance garden in Paris, with its balustrades, many statues, beautiful flower beds, shady chestnut and plane-

tree avenues, the Medici Fountain, and the Avenue of the Observatory, created a charming impression. The gardens of the Tuileries, designed by Le Nôtre in 1665, were in good condition. Flower beds of large dimensions contained admirable groupings of herbaceous perennials instead of the usual summer bedding material. The spacious avenues, the large pools, the fine trees and shrubbery plantings, and the numerous statues made these gardens fine examples of French gardening at its best. Previous to the summer of 1919, the spacious gardens surrounding and beneath the Eiffel Tower were given over to the parking of hundreds of French automobile trucks and trailers used in supply trains, but in 1919 they were in their original state and much admired.

Traveling southwest from Paris toward the Touraine Valley the first stop of importance is Blois. To the architect, the chateau of Blois, one of the most splendid in France, is a masterpiece affording good examples of the various periods of the Renaissance and earlier work. The landscape architect, however, finds little of interest, as there is hardly a trace of the chateau gardens which once existed. Walled portions still remain, but all evidence of the design has vanished. The Avenue Victor Hugo leading from the railroad station to the center of town curves around a charming little public garden with a fountain. In this garden a fine specimen of the Cedar of Lebanon (*Cedrus Libani*) and a California redwood (Sequoia) frame a beautiful view of the elaborate north facade of the chateau.

Leaving Blois, the journey carries one to Amboise, famous for its fine chateau perched on a rock above the village. Here, too, as at Blois, are remnants of gardens, but the original design is lost. Numerous standard roses border the walks, and a portion of the courtyard is covered with a canopy of clipped trees beneath which ferns grow luxuriantly.

Fine roads lead through the extensive forest of Amboise to Chenonceaux, a distance of nine miles. The village lies in the valley of the Cher River on the edge of the forest of Amboise. From the park gates, the chateau is approached through a stately avenue of plane trees, half a mile long. Two granite sphinxes at the opposite end of this avenue guard the entrance to a formal garden enclosed by low walls, brilliant with flowers. A watch-tower on the right of the garden whose walls, mellowed with age, are partly covered with vines, belongs to an earlier castle. As the whole of the chateau stands in the Cher River there are two draw-bridges which connect it with the banks. The castle, with its galleried bridge extending across the river, is unique in construction, and its



CHENONCEAUX—WEST PARTERRE, WATCH-TOWER, AND CHATEAU.

AVENUE OF PLANE TREES AT CHENONCEAUX

reflection in the clear and sparkling, swiftly-flowing water is unusually beautiful. Separated from the chateau by moats whose steep stone-faced banks are half hidden by masses of flowers and vines, are two parterres. The parterre proper is surrounded on four sides by a broad, elevated walk with a low balustrade on its outer margin. Large scrolls of dusty miller (*Artemesia Stelleriana*) are the dominating feature of the parterre. Beds, which in normal times contain flowers, border the walks and are now filled with numerous bays, box-woods, and evergreens trained to standards, pyramids, and globes. Grapes are trellised against the walls of the raised walk. The smaller western parterre is also planted with scrolls of artemesia on a green background, but only a few pyramidal bays for point plants. From the formal gardens shady alley-ways lead through densely wooded areas and terminate in clearings containing some crumbled remnants of a statue or fountain. These avenues are sadly neglected, and progress is at times hindered by fallen trees and branches. Again, mere traces of what formerly were beautiful grassy lanes can be seen. Of all the chateaux the tourist may visit in Touraine, Chenonceaux should be included, for the position is magnificent, the exterior fine, and the gardens interesting.

The city of Tours, four hours by rail south from Paris, is the most convenient center from which to visit numerous chateaux in the valley of the Loire and Cher Rivers.

Seven miles west from Tours the first chateau of importance is that of Luynes, an impressive feudal castle built on a steep ridge above the town. The castle is reached by stone steps, on either side of which are little gardens terraced out of the hillside. Within the chateau there is a square court bounded on three sides by the walls and on the side overlooking the valley of the Loire by a double row of closely clipped trees.

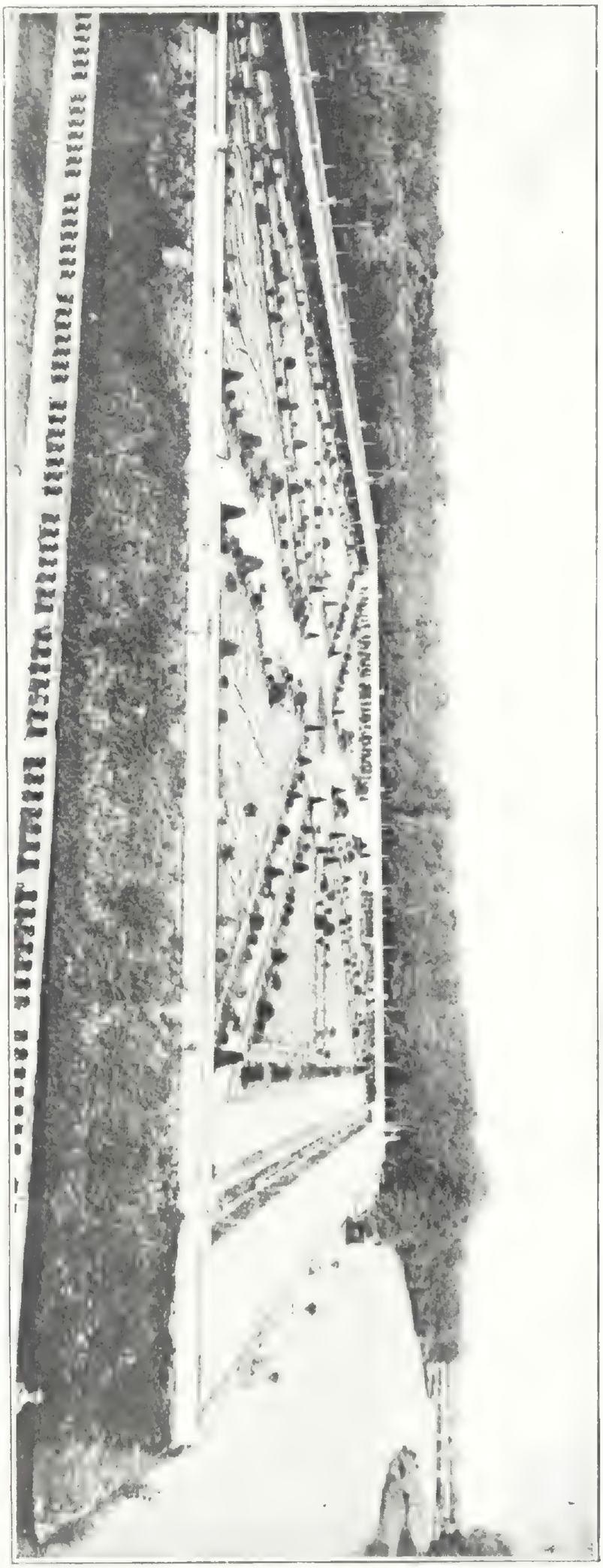
Across the Loire and several miles further west, along the Cher River, lies the village of Villandry with its chateau of the sixteenth century. The building and grounds have been remodeled in recent years and what was formerly a fine lawn is now replaced by three distinct formal gardens. The central and largest of the three is composed of nine square plots, each enclosed by a low latticed fence, upon which dwarf fruit trees are trained by the Cordon system. The plans of the beds in each of the plots differ, but the central feature, a small square pool containing a pedestal and flower vase, is common to all. All the beds, edged with box (Buxus) clipped square and low, contain vegetables or flowers equally spaced to carry out the strictly formal scheme. The outer rectangular beds of each plot contain a variety of dwarf fruit trees. Broad walks

divide the various plots, and each intersection is marked by a square basin from which spouts a single jet of water. These pools are surrounded on four sides by large dome-shaped, latticed retreats covered with climbing roses. One of the nine plots is devoted entirely to roses of both bush and standard variety. Four broad stairs lead to a second formal garden, consisting of three distinct plots which are again divided into quarters. Here also the central feature of each plot is a pool. These plots are unique in that they are composed entirely of various species and varieties of dwarf evergreens closely planted in geometric patterns and clipped level. The dark green of the evergreens serves to bring out the design of the beds. From this garden four ramps lead to a higher level, the southern boundary of the formal gardens, planted to an avenue of plane trees. A moat separates the two gardens just described from a third which adjoins the chateau. This garden is composed of flower beds of various designs surrounded by hedges of box two feet high. Two specimens of the Fortune's palm (*Trachycarpus excelsa*) are planted in this garden, but their location in the design is a question. Ramps of greater dimensions, bordered by trees clipped square, lead up to a point of vantage from which all three gardens can be viewed. A heavy border planting to screen certain buildings on adjoining estates would improve the appearance of the gardens of Villandry.

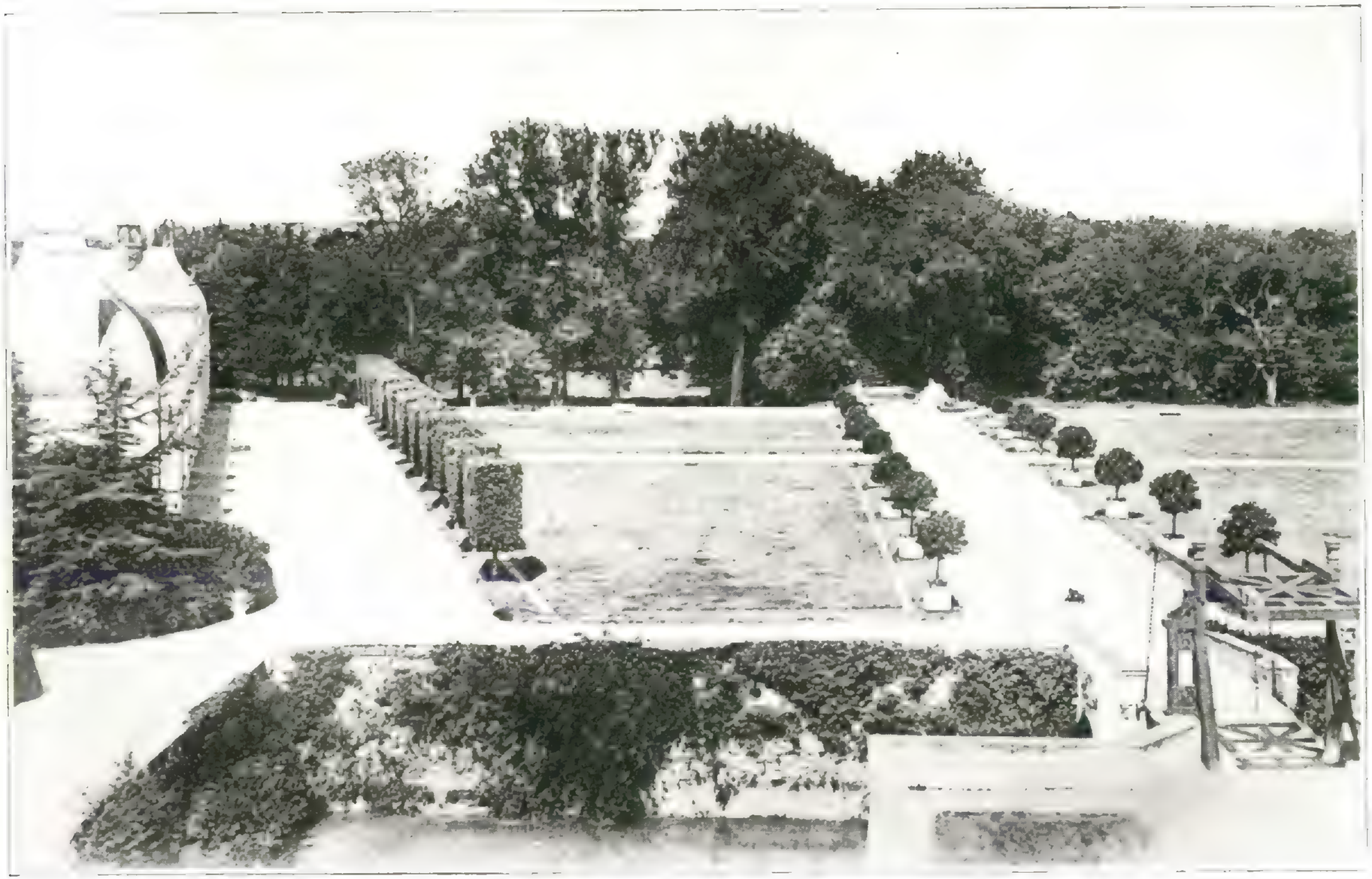
Continuing west from Villandry, but on the north bank of the River Loire, stands the castle of Langeais, considered one of the best examples of military architecture in France. The base of this chateau was once washed by the River Loire, but the river is now confined to its channel by a system of levees. To the rear of the castle is a court, surrounded on three sides by buildings, containing a square parterre which, in the summer of 1919, was not planted.

Recrossing the Loire to the south and a few miles west is the chateau of Usse, built in the fifteenth and sixteenth centuries. It stands on a low hill, and ramps lead down to the gardens beneath. The setting of the building against a solid green background of trees and the ivy-clad balustrades of the ramps are pleasing features of this chateau.

The chateau of Azay-la-Rideau stands in the midst of fine groves of trees, and, as at Chenonceaux, an avenue of planes leads from the gate to the main entrance of the building. The rich and elegant ornamentation of the doors and windows and the towers at the corners of the building reflected in the ponds and moats of placid water make a charming picture. Azay-la-Rideau and Chinon, a distance of approximately twelve miles,



EAST PARTERRE OF GARDEN AT CHENONCEAUX.



LOOKING NORTH FROM WATCH-TOWER AT CHENONCEAUX

are connected by a straight road through the national forest of Chinon. The well-kept national forests of France, with their splendid macadam roads, are a joy to the tourist. Whether any garden was ever associated with the chateau of Chinon, is a question. To the rear of the present ruins are a few small park-like areas frequented by the many visitors who climb the steep paths leading to the ruins.

Numerous chateaux or country homes of minor importance are to be found in the Touraine Valley. Riding through the country along the wonderful French highways one frequently approaches large wooded areas which usually indicate the presence of a chateau. The majority of these buildings were unoccupied in 1918 and 1919, but the keepers in charge always permitted a visit of the grounds. For lack of help, the lawns and beds in most places were neglected, but the vegetables, trained fruits and conservatories were in good condition. The chateaux of Touraine and their gardens will always charm the tourist with their beauty, historical associations, and variety of design.

NATIVE PLANTS SUITABLE FOR THE GARDENS OF MISSOURI AND ADJOINING STATES

VI. NATIVE PERENNIALS FOR NATURAL AND WILD GARDENS

One of the most interesting as well as ornamental ways of utilizing a large number of our native perennials is to plant them in comparatively large masses and in various combinations so as to indicate a natural or spontaneous growth. Plants to be used for this purpose must be of a somewhat robust character, and many plants which would not be at home in the ordinary hardy border would in such a natural arrangement produce a pleasing effect. The plants given in the following list are all such as will flourish under minimum care and attention if given proper soil, light, and moisture. Those suitable for very rocky or moist situations have been noted in previous lists of this series.

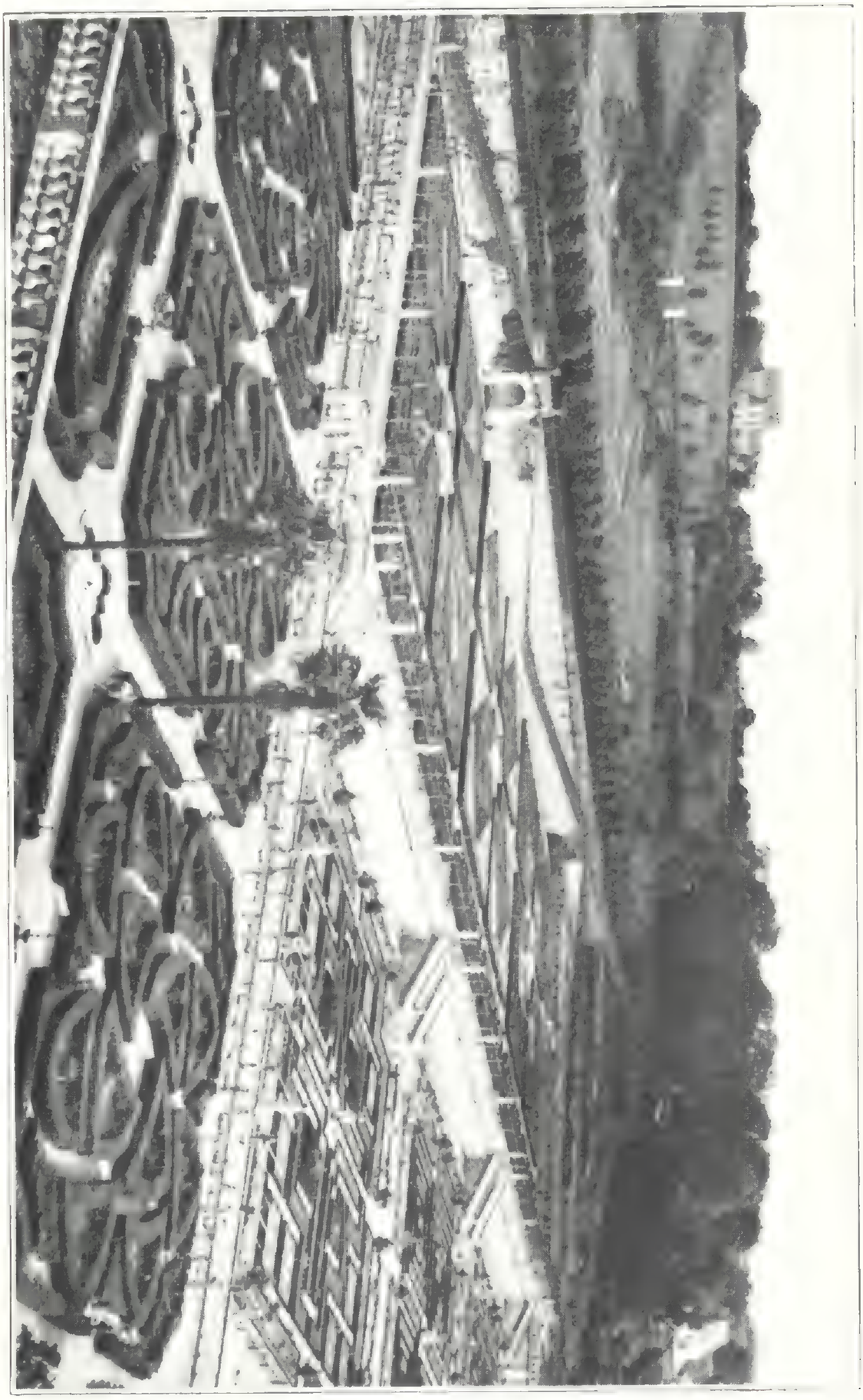
Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
PLANTS GROWING IN DRY, SUNNY SITUATIONS				
3 *Achillea Millefolium*	Yarrow	1-2′	White	Summer
3-9 *Andropogon scoparius*	Brown beard-grass		Grass	
3-8 *Asclepias tuberosa*	Butterfly weed.	1-2′	Orange	June-Aug.

Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
*3 *Aster grandiflorus*	Large-flowered aster	1-3′	Violet	Sept.-Oct.
8 *Aster oblongifolius*	Aromatic aster	1-2′	Pinkish purple	Aug.-Oct.
3-9 *Aster patens*	Late purple aster	1-3′	Purple	Aug.-Oct.
3-8 *Aster sagittifolius*	Arrow-leaved aster	2-4′	Blue	Aug.-Oct.
3 *Aster turbinellus*	Prairie aster	2-3′	Violet	Sept.-Oct.
3 *Baptisia tinctoria*	Wild indigo	2-4′	Yellow	June-Sept.
3-8 *Bouteloua curtipendula*	Racemed bouteloua	1-3′	Grass	
3-8 *Camassia Fraseri*	Wild hyacinth	8-18″	Pale blue	April-May
3 *Chrysanthemum Leucanthemum*	Ox-eye daisy	1-2′	White	May-Aug.
3 *Coreopsis lanceolata*	Lance-leaved tickseed	1-2′	Yellow	Summer
9 *Coreopsis palmata*	Stiff tickseed	1-3′	Yellow	June-July
9 *Cunila origanoides*	American dittany	8-20″	Purple and pink	Aug.-Sept.
3 *Desmodium canadense*	Canadian tick trefoil	2-4′	Purple	July-Sept.
8 *Echinacea angustifolia*	Pale purple cone-flower	1-3′	Purple	July-Oct.
3 *Euphorbia corollata*	Flowering spurge	10″-3′	White	May-Oct.
3 *Helianthus mollis*	Hairy sunflower	2-4′	Yellow	Aug.-Sept.
8 *Heliopsis scabra*	Rough heliopsis	2-4′	Yellow	June-Sept.
3-8 *Heuchera americana*	Alum-root	2-3′	Greenish white	May-Aug.
3-8 *Houstonia angustifolia*	Narrow-leaved houstonia	1-2′	Purplish white	May-July

*Key to soil conditicns:

Two or more numbers indicate a combination of soil conditions; for example 2-4 is loam with a clay subsoil.

1. Clay.
2. Clay subsoil.
3. Clay loam.
4. Loam.
5. Leafmold.
6. Gravelly soil.
7. Sandy loam.
8. Disintegrated limestone.
9. Disintegrated flint.



FORMAL GARDEN AT VILLANDRY.

	Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
3	*Houstonia minima*	Least bluet	1-3"	Blue	March-May
3	*Houstonia purpurea*	Large houstonia	4-15"	Purple	May-Sept.
8	*Lepachys pinnata*	Gray-headed cone-flower	2-4′	Yellow	June-Sept.
3	*Liatris cylindracea*	Cylindric blazing-star	1-2′	Purple	July-Sept.
3	*Liatris elegans*	Handsome blazing-star	1-3′	Rose	Aug.-Oct.
3-8	*Liatris graminifolia*	Loose-flowered button snake-root	1-3′	Purple	Aug.-Sept.
3-8	*Liatris punctata*	Dotted button snakeroot	1-2′	Purple	Aug.-Oct.
3-8	*Liatris pycnostachya*	Hairy button snakeroot	2-4′	Purple	Aug.-Sept.
3-8	*Liatris scariosa*	Largo button snakeroot	2-5′	Purple	Aug.-Sept.
3-8	*Liatris squarrosa*	Blazing-star	1-3′	Purple	June-Sept.
3	*Lilium philadelphicum*	Wood lily	2-3′	Reddish orange	June-July
3	*Linaria vulgaris*	Butter-and-eggs	1-2′	Yellow	June-Sept.
3	*Lysimachia punctata*	Spotted loosestrife	2-3′	Yellow	June-July
3-8	*Monarda Bradburiana*	Bradbury's monarda	8-18"	Pink	May-June
3	*Monarda fistulosa*	Wild bergamot	2-4′	Pink	June-Sept.
3-8	*Oenothera missouriensis*	Missouri primrose low, tufted		Yellow	May-July
3	*Oenothera speciosa*	Showy primrose	1-2′	White or pink	May-July
3	*Panicum virgatum*	Tall smooth panicum	1-3′	Grass	
3	*Parthenium integrifolium*	American feverfew	1-3′	White	May-Sept.
8	*Parthenium repens*	Creeping parthenium	6-18"	White	April-July
3	*Phlox amoena*	Hairy phlox	6-18"	Pink	April-June
3	*Phlox paniculata*	Garden phlox	1-3′	Pink or white	July-Sept.
3-8	*Phlox pilosa*	Downy phlox	6-12"	Pink or white	April-June
8	*Psoralea tenuiflora*	Few-flowered psoralea	2-4′	Purplish	May-Oct.

	Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
3	*Saponaria officinalis*	Bouncing Bet	1-2′	Pink	Summer
3	*Silphium integrifolium*	Entire-leaved rosin-weed	2-5′	Yellow	Aug.-Sept.
3	*Sisyrinchium graminoides*	Blue-eyed grass	6-12″	Blue	April-June
3-8	*Solidago rigida*	Hard-leaved golden-rod	1-4′	Yellow	Aug.-Oct.
3-8	*Solidago ulmifolia*	Elm-leaved golden-rod	2-4′	Yellow	July-Sept.
3	*Stenanthium gramineum*	Grass-leaved stenanthium	2-4′	White	Aug.-Sept.
3	*Tradescantia brevicaulis*	Short-stemmed spiderwort	6-12″	Rose-purple	April-May
3	*Tradescantia rosea*	Roseate spiderwort	6-12″	Rose	April-Aug.
3-8	*Verbena canadensis*	Large-flowered verbena	8-15″	Blue	April-July
3	*Vernonia Baldwinii*	Baldwin's iron-weed	2-4′	Purple	July-Sept.
3	*Vernonia crinita*	Great iron-weed	3-6′	Purple	Aug.-Oct.
3	*Viola palmata*	Early blue violet (tufted)	6″	Blue	March-May
9	*Viola pedata*	Bird's-foot violet (tufted)	3-10″	Lilac or blue	March-June

PLANTS GROWING IN DRY, PARTIALLY SHADED SITUATIONS

3	*Asclepias purpurascens*	Purple milk-weed	2-4′	Purple	June-Aug.
8	*Aster laevis*	Smooth aster	2-4′	Violet or blue	Sept.-Oct.
3	*Cimicifuga racemosa*	Black snakeroot	3-8′	White	June-Aug.
3	*Scutellaria cordifolia*	Heart-leaved skullcap	1-3′	Blue	Aug.-Oct.
3	*Solidago odora*	Sweet-scented golden-rod	1-3′	Yellow	July-Sept.
3	*Thalictrum dioicum*	Early meadow rue.	1-2′	Greenish	April-May
3	*Thalictrum polygamum*	Tall meadow rue	3-8′	White	July-Sept.
3	*Thalictrum purpurascens*	Purplish meadow rue.	4-7′	Purple	June-Aug.

	Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
	PLANTS GROWING IN MOIST, SUNNY SITUATIONS				
3	*Anemone canadensis*	Canada anemone	1-2′	White	May-Aug.
3	*Anemone multifida*	Red wind-flower	6-18″	Greenish red	Summer
3	*Aster amethystinus*	Amethyst aster	2-4′	Purple	Sept.-Oct.
3	*Aster novae-angliae*	New England aster	3-6′	Violet-purple	Sept.-Oct.
3	*Aster novi-belgii*	New York aster	1-3′	Violet	Aug.-Oct.
3	*Aster salicifolius*	Willow-leaved aster	2-4′	White	Aug.-Oct.
3	*Baptisia australis*	Blue false indigo	2-4′	Indigo-blue	June-Aug.
3	*Boltonia asteroides*	Aster-like boltonia	3-6′	Pinkish or white	July-Sept.
3	*Boltonia latisquama*	Broad-scaled boltonia	3-6′	Violet-blue	July-Sept.
3	*Cassia marylandica*	Wild senna	3-5′	Yellow	July-Aug.
3	*Coreopsis tripteris*	Tall tickseed	3-6′	Yellow	July-Oct.
3	*Dodecatheon Meadia*	Shooting-star	8″-2′	Purple, pink, or white	April-May
8	*Echinacea purpurea*	Purple cone-flower	2-4′	Purple	July-Oct.
3	*Eryngium yuccaefolium*	Button snakeroot	2-6′	B'uish	June-Sept.
3	*Helenium autumnale*	Sneezeweed	2-4′	Yellow	Aug.-Oct.
3	*Hemerocallis fulva*	Day-lily	2-3′	Orange	May-July
3	*Hibiscus Moscheutos*	Swamp rose-mallow	3-5′	Pink or white	Aug.-Sept.
3	*Lilium canadense*	Wild yellow lily	2-4′	Yellow	June-July
3	*Lilium tigrinum*	Tiger lily	2-4′	Orange-red	Summer
3	*Lythrum Salicaria*	Purple loosestrife	2-3′	Purple	June-Aug.
3	*Pentstemon glaber*	Large smooth beard-tongue	1-2′	Blue	May-Aug.
3	*Physostegia virginiana*	False dragon-head	1-3′	Rose	July-Sept.
3	*Rudbeckia laciniata*	Tall cone-flower	3-8′	Yellow	July-Sept.
3	*Rudbeckia speciosa*	Showy cone-flower	1-3′	Yellow	Aug.-Oct.
3	*Solidago serotina*	Late golden-rod	3-6′	Yellow	Aug.-Oct.
3	*Stenanthium robustum*	Stout stenanthium	2-4′	Greenish white	July-Sept.

Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
3 *Tradescantia virginiana*	Spiderwort	1-3′	Blue	May-Aug.
6 *Vernonia fasciculata*	Western ironweed	2-4′	Purple	July-Sept.
3 *Viola striata*	Pale or striped violet (tufted)	6-10″	Whitish	April-May
3-8 *Zizia aurea*	Golden meadow parsnip	12-30″	Yellow	April-May
3-8 *Zizia cordata*	Heart-leaved alexanders	2-3′	Yellow	May-June

PLANTS GROWING IN MOIST, PARTIALLY SHADED SITUATIONS

3 *Claytonia virginica*	Spring beauty.	6-12″	White or pink	March-May
3-8 *Dicentra Cucularia*	Lutchman's breeches	5-10″	White	April-May
3-5 *Dicentra eximia*	Wild bleeding-heart	6-10″	Pink	April-Sept.
3-5 *Erythronium albidum*	White adder's-tongue	6-12″	White	March-May
3-5 *Erythronium americanum*	Yellow adder's-tongue	6-12″	Yellow	March-May
3-8 *Eupatorium ageratoides*	White snake-root	1-3′	White	July-Oct.
3 *Eupatorium coelestinum*	Mist-flower	1-2′	Blue	Aug.-Oct.
3 *Geranium maculatum*	Wild crane's-bill	1-2′	Rose-purple	April-July
3 *Meibomia Dillenii*	Dillen's tick trefoil	2-3′	Purple	Aug.-Oct.
3-7 *Mertensia virginica*	Virginian cowslip	1-2′	Blue	April-May
3 *Panicum clandestinum*	Hispid panicum	2-3′	Ornamental grass	
3 *Pentstemon Digitalis*	Foxglove, beard-tongue.	1-3′	White	May-July
3 *Pentstemon laevigatus*	Smooth beard-tongue.	1-3′	Purplish	May-July
3-5 *Phlox divaricata*	Wild blue phlox	6-12″	Blue	April-June
3 *Podophyllum peltatum*	May apple	12-18″	White	May

	Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
3-5	*Polemonium reptans*..	Greek valerian	6-12"	....Blue	.....April-May
3-8	*Solidago flexicaulis*...	Broad-leaved golden-rod ..	1-2′	....Yellow	.....July-Sept.
3	*Thaspium trifoliatum*	Purple meadow parsnip	1-2′	....Purple	.....April-July
8	*Viola pubescens*.....	Hairy yellow violet (tufted)	6"-1′	....Yellow	.....April-May

VII. HARDY NATIVE FERNS AND PLANTS OF SIMILAR CULTURE

The native ferns are not as easily cultivated in this part of the country as in the more moist eastern sections. They are, however, well worthy of attention if proper location for their culture can be had. Most of the ferns require shade, leaf mold, and moisture, such as is afforded in their natural environment. Those who are fortunate enough to have a natural ravine through which a small stream flows and which is shaded by a growth of deep-rooted native hardwood trees are in possession of a proper location for a fern garden. If the soil is not naturally rich in leaf mold this deficiency should be remedied before planting the ferns.

The location suitable for most of the ferns will also be ideal for the growing of some of our rare and beautiful perennials. A few of the latter have been appended to the list, as well as some particularly interesting and desirable shrubs and small trees suitable for an undergrowth to the larger trees and as a background for the ferns and perennials.

NATIVE HARDY FERNS

	Botanical name	Common name	Approx. height	Location.
3-5	*Adiantum pedatum*...	Maiden-hair fern	12-18"	....Rich shady woods and banks
3-5	*Asplenium angustifolium*	Narrow-leaved spleenwort..	1-2′	....Moist woods
3-5	*Asplenium acrostichoides*	Silvery spleenwort..	1-3′	....Rich moist woods

	Botanical name	Common name	Approx. height	Location.
3-5	*Asplenium platyneuron*	Ebony spleenwort	6-15″	Rocks and banks
3-5	*Asplenium Trichomanes*	Maiden-hair spleenwort	1-6″	Rocks
3-5	*Cystopteris bulbifera*	Bulblet cystopteris	1-2′	Moist rocky ground
3-5	*Cystopteris fragilis*	Brittle fern	6-12″	Moist rocky ground
3-5	*Dryopteris acrostichoides*	Christmas fern	1-2′	Woods and shady banks
3-5	*Dryopteris felix-mas*	Male fern	1-3′	Rocky woods and banks
3-5	*Dryopteris marginalis*	Evergreen wood-fern	1-2′	Rocky woods and banks
3-5	*Onoclea sensibilis*	Sensitive fern	2-3′	Moist ground
3-5	*Onoclea Struthiopteris*	Ostrich fern	1-2′	Moist shady ground
3-7	*Osmunda cinnamomea*	Cinnamon fern	2-3′	Wet sandy ground
3-5	*Osmunda Claytoniana*	Clayton's fern	2-4′	Marshy ground
3-5	*Osmunda regalis*	Royal fern	3-4′	Marshy ground
3	*Pellaea atropurpurea*	Purple-stemmed cliff-brake	6-12″	Moist rocks
3-5	*Phegopteris Dryopteris*	Oak fern	6-12″	Moist woods
3-5	*Phegopteris hexagonoptera*	Broad beech fern	6-12″	Dry woods and hillsides
3-5	*Polypodium vulgare*	Common polypody	6-12″	Moist rocks and banks
3-5	*Pteris aquilina*	Brake	2-4′	Dry open ground
3-5	*Woodsia obtusa*	Blunt-lobed woodsia	6-12″	Moist rocky ground

HARDY PERENNIAL PLANTS FOR GROWING WITH OR AMONG FERNS

	Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
3	*Aconitum noveboracense*	New York monkshood	2′	Blue	June-Aug.
3	*Aconitum reclinatum*	Trailing wolf's bane	Trailing	White	July-Aug.
3	*Aconitum uncinatum*	Wild monkshood	2-3′	Blue	June-Sept.

	Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
8	*Actaea alba*	White baneberry	1-2′	White	April-June
8	*Actaea rubra*	Red baneberry	1-2′	White	April-June
3-8	*Aquilegia canadensis*	Wild columbine	1-2′	Scarlet	April-July
3-5	*Arisaema triphyllum*	Jack-in-the-pulpit	1-2′	Brownish green	April-May
3-5	*Asarum canadense*	Wild ginger	6-10″	Purple	April-May
3	*Astilbe biternata*	False goat's beard	3-6′	Yellowish white	June
3-5	*Cypripedium candidum*	Small white lady's slipper	6-12″	Greenish white tinged with purple	May-June
3-5	*Cypripedium hirsutum*	Large yellow lady's slipper	1-2′	Yellow	May-June
3-5	*Cypripedium spectabile*	Showy lady's slipper	1-2′	Purple and white	May-June
3-5	*Delphinium tricorne*	Dwarf larkspur	1-2′	Blue	April-June
3-5	*Dicentra canadensis*	Squirrel corn	6-12″	Greenish white	May-June
3	*Gentiana flavida*	Yellowish gentian	1-3′	Yellowish white	Aug-Oct.
3	*Gentiana puberula*	Downy gentian	8-18″	Blue	Aug.-Oct.
3-5	*Hepatica acutiloba*	Heart liver-leaf	4-6″	Blue, purple or white	March-May
3-5	*Hepatica triloba*	Kidney liver-leaf	4-6″	Blue, purple or white	March-May
7	*Hexalectris aphylla*	Crested coral-root	8-20″	Brownish purple	July-Aug.
3-5	*Hydrophyllum canadense*	Broad-leaved water-leaf	6-18″	White	June-July
3-5	*Hydrophyllum macrophyllum*	Large-leaved water-leaf	1-2′	Whitish	May-June
3-5	*Hydrophyllum virginianum*	Virginia water-leaf	1-2′	Bluish white	May-Aug.
7	*Isopyrum biternatum*	False rue anemone	6″-1′	White	May
3-5	*Mitella diphylla*	Mitre-wort	10-18″	White	April-May
3-5	*Osmorhiza brevistylis*	Wooley sweet Cicely	18″-3′	White	May-June
3-8	*Polygonatum biflorum*	Hairy Solomon's seal	2′	White	April-June

	Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
3-8	*Polygonatum commutatum*	Smooth Solomon's seal	2-4′	White	May-July
3-5	*Sanguinaria canadensis*	Bloodroot	6-12″	White	March-May
3	*Spiraea Aruncus*	Goat's-beard	2-4′	White	May-July
3	*Smilacina racemosa*	False Solomon's seal	1-2′	White	May-June
3	*Trillium erectum*	Large white wake-robin	8-18″	White	April-May
3	*Trillium grandiflorum*	Large-flowered wake-robin	6-12″	Pinkish white	May-June
3-5	*Trillium recurvatum*	Prairie wake-robin	6-18″	Purple	April-May
3-5	*Uvularia grandiflora*	Large-flowered bellwort	1-2′	Yellow	April-June
3	*Uvularia perfoliata*	Perfoliate bellwort	6-20″	Yellow	May-June

The following small trees and shrubs are particularly adapted for use as a background for a fern garden, the conditions of soil, shade, and moisture being about the same as for the ferns in the above-mentioned list.

	Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
3	*Asimina triloba*	North American papaw	10-40′	Dark purple	March-April
3	*Azalea lutea*	Flame azalea	4-15′	Yellow or red	May-June
3-5	*Azalea canescens*	Mountain azalea	4-15′	Rose to white	April-May
3	*Cercis canadensis*	Red-bud	15-25′	Pinkish purple	March-April
3-5	*Clethra alnifolia*	Sweet pepperbush	3-10′	White	July-Aug.
3	*Cornus florida*	Flowering dogwood	20-40′	White	April-May
3-5	*Kalmia angustifolia*	Sheep-laurel	1-3′	Purple or crimson	May-June
3	*Oxydendrum arboreum*	Sorrel tree	To 60′	White	June-July
3	*Ptelea trifoliata*	Hop tree	To 20′	Greenish white	June
8	*Xanthoxylum americanum*	Prickly ash	To 20′	Greenish	April-May
8	*Xanthoxylum Clava-Herculis*	Southern prickly ash	To 20′	Greenish white	June

NOTES

Prof. Etienne Foëx, Director of the Plant Pathology Station, Paris, France, visited the Garden, August 23, during his tour of this country.

Mr. C. R. Hursh, formerly Rufus J. Lackland fellow, has been appointed assistant pathologist on rust investigations at the University of Minnesota.

Mr. G. H. Pring, Horticulturist to the Garden, was elected Vice-President of the National Association of Gardeners at its recent convention in St. Louis.

Mr. L. P. Jensen, Arboriculturist to the Garden, attended the convention of the American Association of Park Superintendents, at Louisville, September 9-11.

Mrs. Adele Lewis Grant, formerly Teaching Fellow in the Henry Shaw School of Botany, has accepted a position as instructor in botany at Cornell University.

Dr. Norma E. Pfeiffer, of the University of North Dakota, spent several days at the Garden recently in connection with her monographic studies of the genus Isoetes.

Dr. Hermann von Schrenk, Pathologist to the Garden, visited the Coastal Botanical Laboratory, Carnegie Institution, Carmel, California, during the summer.

Dr. Hermann von Schrenk, Pathologist to the Garden, addressed the Association of Engineering Societies at San Francisco, September 1, on "Wood Preservation."

Mr. George M. Armstrong, Rufus J. Lackland fellow, was employed during the summer on a study of the nematode disease in the Bureau of Plant Industry, U. S. Department of Agriculture.

Dr. Takashi Matsumoto, who took his doctorate in botany at the commencement of Washington University in June, will sail for Europe, October 6, where he will spend six months before returning to Japan.

Dr. W. B. Brierly, mycologist to the Rothamsted Experiment Station, Harpenden, England, who was in this country at the invitation of the Phytopathological Society, stopped over in St. Louis, September 9-10, to visit the Garden.

Mr. G. H. Pring, Horticulturist to the Garden, was awarded a gold medal by the National Association of Gardeners for the

creation of a new water-lily, *Nymphaea* "Mrs. Edwards Whitaker." This is only the second time in the history of the association that the gold medal has been awarded.

Recent visitors to the Garden include Prof. E. M. East, of the Bussey Institution, Harvard University; Mr. J. B. Demaree, of the Pecan Disease Laboratory, U. S. Department of Agriculture, Thomasville, Georgia; Dr. George L. Peltier, Professor of Plant Pathology, University of Nebraska; Mr. George W. Hess, Director U. S. Botanic Gardens, Washington, D. C.; Lord and Lady Cave, of London, England.

The annual convention of the National Association of Gardeners was held in St. Louis, September 14-16, at the Marquette Hotel. The meetings were opened with an address of welcome by Dr. George T. Moore, Director of the Garden. On September 15 the visitors attending the convention were invited to the annual gardeners' banquet provided for in Mr. Shaw's will, which was held in the floral display house at the Garden. Dr. Hermann von Schrenk, Pathologist to the Garden, delivered the after-dinner address on "Pacific Coast Trees." On September 16 the Garden Club of St. Louis entertained the visitors with a luncheon at Bevo Mill. After the luncheon an automobile drive through the city was taken, a stop-over of about an hour being made at the Garden to view the buildings and grounds.

STATISTICAL INFORMATION FOR JUNE—AUGUST, 1920

GARDEN ATTENDANCE:

Total number of visitors in June	13,965
Total number of visitors in July	17,587
Total number of visitors in August	24,419

PLANT ACCESSIONS:

Total number of plants and seeds received as gifts in July	16

PLANT DISTRIBUTION:

Total number of plants and seeds distributed as gifts in June	35
Total number of plants distributed in exchange in July	39
Total number of plants distributed in exchange in August	100
Total number of packets of seed distributed in exchange in August	131

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought in June	38
Total number of books and pamphlets donated in June	514
Total number of books and pamphlets bought in July	32
Total number of books and pamphlets donated in July	89
Total number of books bought in August	24
Total number of books and pamphlets donated in August	50

JUNE

HERBARIUM ACCESSIONS:

By Purchase—

C. F. Baker—"Fungi Malayana, Cent. VI, Nos. 501-600, inclusive	100
Rev. John Davis—Plants of Michigan and Nebraska	213
John M. Holzinger—"Musci Acrocarpi Boreali-Americani," Fasc. XVI, Nos. 376-400, inclusive	25
Prof. Morton E. Peck—Plants of Oregon	483

By Gift—

J. S. Bemis—*Ulmus americana* L. from Tennessee	1
T. S. Brandegee—Unknown Compositae from Mexico	1
Dr. A. Davidson—*Ceanothus* sp. from California	1
Mr. Fritts—*Xanthoxylum Clava-Herculis* L. from Florida	1
Dr. Harold Hume—*Ilex* sp. from Florida	1
Mrs. J. M. Jackson—Cultivated specimen of *Rosa gallica* L. var. *cristata* Curt	1
Royal Botanic Gardens, Kew, England—Fragment of type and drawings of *Mimulus peduncularis* Dougl.	1
W. H. Snell—Fungi from Lake Winnepesaukee, N. H.	3
A. L. Stone—*Nasturtium austriacum* Crantz, from University Farm, College of Agriculture, Madison, Wisconsin	1
Dr. Hermann von Schrenk—Specimens of pine from British Honduras	4
John Waltz—Specimens of flowering plants from Illinois	2
Dr. J. R. Weir—Fungi from Mexico and other localities	7
Dr. A. Yasuda—Japanese fungi	22

By Exchange—

Botanic Gardens, Sydney, Australia—Plants of Australia	100
C. R. Orcutt—Type specimens of *Echinocereus Orcuttii* and *Hasseanthus Orcuttii* Rose	2
Pomona College, by Prof. C. A. Munz—Plants of California	35
New York Botanical Garden, by M. A. Howe—Algae chiefly from the West Indies	225

JULY

By Gift—

J. A. Drushel—Plants of Ohio, Illinois, Missouri and Washington	27
Jas. H. Ferriss—*Phlox argillacea* Clute & Ferriss, from Illinois	1
Dr. J. M. Greenman—Plants of St. Louis County, Mo.	27
Mrs. Katherine Leigh—Plants of Yellowstone National Park	17
C. G. Lloyd—*Stereum fasciculatum* from Colorado	1
John Waltz—*Phlox* sp. from Illinois	1
Dr. S. M. Zeller—Fungi from Oregon	10

AUGUST

By Gift:

J. A. Drushel—Plants of Illinois, Missouri and Texas	17
August Koch—Crown gall on Carolina poplar.....	1
C. G. Lloyd—*Septobasidium pseudopedicellatum* Burt from South Africa.....	1
Dr. L. O. Overholts—*Thelephora vialis* Schw. and *Craterellus Cantharellus* Schw.	2
W. H. Snell—*Septobasidium* on white pine.....	1
Dr. M. L. Whetstone—*Merulius erectus* Lloyd, cotype	1
Total	1,336

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MISSOURI BOTANICAL GARDEN BULLETIN

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PERESKIA ACULEATA

Missouri Botanical Garden Bulletin

Vol. VIII St. Louis, Mo., October, 1920 No. 8

PERESKIA ACULEATA

This genus of the cactus family is named in honor of Nicolas Claude Fabry de Peiresse and frequently is referred to as the Barbados gooseberry, lemon vine, or blade apple. Originally the genus included upwards of forty species, but only thirteen are recognized at present, the remaining being classified under allied genera.

Pereskia aculeata, its variety *Godseffiana,* and *P. Bleo* may be recommended as greenhouse climbers, growing luxuriantly and producing an abundance of flowers despite low temperature and drought. These climbers are indigenous to South America, in regions subject to dry seasons. The plants of this genus are rarely regarded as true cacti in view of their foliage characteristics which resemble the ordinary type of climbers. Upon handling, however, their cactus habit is soon discovered through the spines which are arranged along the various nodes at the base of the leaves. In the young growth they are short, rigid, bicornute and green. In the woody branches they are arranged in clusters upon a cushion of downy pubescence and are dark brown in color. In *Pereskia Bleo* the spines are more prominent, being fully two inches in length. This plant is a much stronger grower than *P. aculeata* and produces larger leaves and branches. The flowers are mauve-pink and at a distance may be mistaken for those of the common briar. The spines of this and other cacti have been tried as a substitute for steel needles for phonograph machines but have proven too brittle.

Pereskia aculeata is a common species in cactus collections, being used as stock on which to graft various other cacti. The favorite Easter cactus, *Epiphyllum truncatum,* is grafted upon the strong-rooting Pereskia stock to influence the growth and a greater production of flowers. Well-ripened wood in lengths varying from six to ten inches is selected for the grafting stock. These hardwood cuttings will root readily in sand in the ordinary propagating bench, or if the operation

is tried in the home, by placing a glass covering over the pot. The old spines are used to secure the detached Easter cactus to the stock of Pereskia. *P. aculeata,* from the standpoint of a climber, is very satisfactory, perhaps the only objection being its deciduous habit during the winter. This, however, is counterbalanced by its ornamental as well as edible fruit. When ripe it resembles the gooseberry and is used for making jelly and drinks. The branches are of a woody texture when mature, bearing clusters of spines about an inch long. The young shoots have but two short, horn-like spines which are slightly curved and of a dark green color. The flowers are pale yellow, about an inch in diameter, and hang in long festoons five to six feet in length. The large specimen in the succulent house at the Garden is so fragrant that its perfume penetrates into the economic house. This plant has frequently been called the climbing orange blossom.

The variety *Godseffiana* possesses leaves colored crimson, yellow, and green upon the upper surface. When first introduced at the Garden it was planted in the experimental plot with a view of using it as a bedding plant in this section of the country. Experience showed however, that its foliage turned to a greenish yellow, becoming deciduous in the fall. When grown in a greenhouse with combined heat and moisture its tricolors are very prominent.

TEST GARDEN, 1920

In 1919 a test garden was established at the south end of the garden, the contents of which was listed in the May, 1919, number of the BULLETIN.

Following is a list of plants grown during the summer of 1920:

Achyranthes Biemuelleri
Achyranthes formosa
Achyranthes "Panache de Bailey"
Aegopodium Podograria variegatum
Agathaea coelestis
Ageratum Fraseri
Ageratum mexicanum "Dwarf White"
Ageratum mexicanum "Imperial Dwarf Blue"
Ageratum mexicanum "Little Blue Star"
Alyssum maritimum "Little Gem"
Alyssum maritimum "Snow Carpet"
Alyssum minimum
Amaranthus hypochondriacus
Antirrhinum majus "Intermediate"
Antirrhinum majus "Tall"
Antirrhinum majus "Tom Thumb"
Arctotis grandis
Artemisia Stelleriana

GIANT MALLOW (HIBISCUS MANIHOT).

Begonia semperflorens "Crimson Bedder"
Begonia semperflorens "Vernon"
Calliopsis radiata "Tiger Star"
Callistephus chinensis "Heart of France"
Callistephus chinensis "Hercules"
Callistephus chinensis "Ostrich Plume"
Callistephus chinensis "Silvery Pink"
Callistephus chinensis "Silvery Rose"
Celosia Childsii
Celosia chrysanthefolia "Celosiamum"
Centaurea gymnocarpa
Cerastium tomentosum
Coleus sp.
Cosmos bipinnatus "New Double Crimson"
Cyperus natalensis
Dahlia rosea "Mignon"
Dahlia rosea "Peony-flowered"
Dahlia rosea "Peter Pan"
Dahlia rosea, double
Delphinium Ajacis "Blue Gem"
Delphinium chinense
Dianthus barbatus "Brilliant Red"
Erlangea tomentosum
Eschscholtzia californica "The Geisha"
Gerbera Jamesonii
Geum chiloense "Mrs. Bradshaw"
Gilia micrantha
Helianthus annuus "Giant Red"
Helianthus annuus "Prolific White"
Helianthus annuus "Wine and Primrose"
Hibiscus Manihot "Giant Mallow"
Iberis amara coronaria "Improved White Spiral Candytuft"
Impatiens Holstii
Lantana sp.
Lobelia Erinus "Bedding Queen"
Lobelia Erinus "Dark Blue"
Lobelia hybrida "Sapphire"
Lychnis coronaria, crimson
Mesembryanthemum cordifolium
Mesembryanthemum floribundum
Mesembryanthemum tricolor
Mesembryanthemum variegatum
Papaver Rhoeas "Flanders Field Poppy"
Papaver Rhoeas "Munstead Cream Pink"
Perilla frutescens "Dwarf Curled"
Perilla frutescens nankinensis
Petunia hybrida, blue
Petunia hybrida "Pearl of Kentfield"
Petunia hybrida, pink
Petunia hybrida "Roehr's Glory"
Petunia hybrida, red
Petunia hybrida, variegated
Petunia hybrida, white
Salvia splendens "Globe of Fire"
Salvia splendens, purple
Salvia azurea grandiflora
Sedum caeruleum

Senecio multibracteatus
Tunica Saxifraga
Verbena hybrida grandiflora "Rose Queen"
Verbena hybrida grandiflora "Lucifer"
Zinnia elegans "Achievement"
Zinnia elegans "Double Dahlia-flowered"
Zinnia elegans "Giant Dahlia"
Zinnia elegans "Picotee"
Zinnia elegans "Quilled"
Zinnia robusta grandiflora plenissima "Rose King"

All of the plants received the same amount of cultivation and moisture. Some grew remarkably well, while others were partial or total failures. Many of the plants advertised as novelties or superior to well-known varieties proved, under existing conditions at least, to be no better than those growing in the Garden. The following notes describe briefly the most interesting plants of this season.

Calliopsis radiata "Tiger Star" grew to a height of ten inches and was covered with many small brown flowers. It was advertised as a continuous bloomer, but in the test garden the plants all died after their first flowering the latter part of June. It was attractive when in bloom, but its season short.

Celosia chrysanthefolia "Celosiamum," claimed to be a cross between *Celosia Childsii* and *argentea*, proved to be very variable. Some plants could not be distinguished from *Celosia Childsii*, the Chinese wool flower, and others resembled *Celosia argentea*. No flowers were produced as advertised.

Dahlias were readily grown from seed and gave great satisfaction in the wealth and variety of bloom. From a packet of peony-flowered dahlia seed, obtained from an English firm, a number of exceptionally large, double flowers were derived. One especially good plant produced large, lavender peony-type flowers, which measured seven inches across.

The annual *Delphinium Ajacis* "Blue Gem" was a good dwarf plant. Seed sown the middle of March produced blooming plants during July and August. In September fresh growths were sent up which bloomed in October. Seeds did not set freely.

The "Prolific White Sunflower," *Helianthus annuus*, distributed by a western firm, was said to grow only three feet tall, but those in the test garden grew six and seven feet. The heads were very large and contained many white seeds, few of which were fertile.

The "Flanders Field Poppy," *Papaver Rhoeas*, produced an abundance of red flowers throughout the greater part of the summer, equal in size and color to those so numerous in European fields.

Papaver Rhoeas, "Munstead Cream Pink" is considered a novelty by an English firm. The flowers, borne on long stems, were large, single and double, and of a delicate shell-pink. The plants bloomed for a month in midsummer, but after the seed-pods ripened the entire plants disappeared. It is regretted that such good plants should have such a short season.

A giant mallow, *Hibiscus Manihot*, sold by a New York firm as a new plant, attained a height of ten feet and during September and October bore many large, light yellow flowers measuring six to eight inches across. The plants were robust, required no staking, and contained heavy foliage unaffected by insects. To obtain flowers in August seeds should be sown in February, as it requires fully six months to produce blooming plants. Attempts to cross this mallow with *Hibiscus coccineus*, *Moscheutos* and *sinensis* were unsuccessful.

Seed of *Iberis amara coronaria* "Improved White Spiral Candytuft" were started indoors the middle of March. During the last half of June and the greater part of July the plants were covered with dense spikes of pure white flowers, and beds of this candytuft were most attractive. Seeds were produced abundantly, after which the plants died, the season ending the middle of August.

A number of hybrid frilled, purple and blue petunias were grown. The hybrid frilled and purple petunias produced large flowers, but the foliage was poor. The stems were weak, the plants requiring considerable staking to keep them presentable, and seeds seldom were produced even with the aid of hand pollination. The blue petunia, however, grew well and produced an abundance of flowers of average size throughout the season. The foliage was good, the plants self-supporting, and seeds abundant.

A purple salvia, presented to the Garden by Mr. G. B. Moulder, Landscape Architect, Park Department, Nashville, Tenn., is said to be a sport from the red *Salvia splendens*. The plants grew to a height of two and one-half feet and from July until frost bore deep purple flowers, almost too dark to be attractive.

Plants of *Tunica Saxifraga* were grown from seed to determine their suitability as rock-garden plants in this locality. From August until frost the low, creeping plants were covered with delicate, pink flowers. From the manner in which *Tunica Saxifraga* grew and flowered during this season, it can safely be recommended as a plant adapted to growing in rock gardens.

In referring to the list it will be noted that not all the plants were novelties. Some of them were merely given a

trial to determine if suited to some particular purpose. For instance, the various achyranthes, ageratums, alyssums, and lobelias were grown side by side to compare their suitability as bedding plants in St. Louis. The majority of the plants grown in the test garden the past two seasons have been annuals, but it is the intention to gradually add perennials as they become available.

NATIVE PLANTS SUITABLE FOR THE GARDENS OF MISSOURI AND ADJOINING STATES

VIII. NATIVE SHRUBS FOR MASS PLANTING, FLOWERS INCONSPICUOUS

Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
PLANTS GROWING IN MOIST, SUNNY SITUATIONS				
*6 *Alnus incana*	Speckled alder	8-25′	Inconspicuous	April-May
3 *Andrachne phyllanthoides*	Andrachne	1-3′	Yellowish green	Summer
3 *Ilex decidua*	Swamp holly	15-25′	Inconspicuous	May
3 *Ilex opaca*	American holly	20-50′	Inconspicuous	April-June
3 *Ilex verticillata*	Winterberry	6-25′	Inconspicuous	May
3 *Salix cordata*	Heart-leaved willow	5-10′	Inconspicuous	April-May
3 *Salix lucida*	Shining willow	10-15′	Inconspicuous	April-May
3 *Salix sericea*	Silky willow	4-8′	Silvery gray	April-May
PLANTS GROWING IN MOIST, SHADY SITUATIONS				
7 *Dirca palustris*	Leather-wood	2-5′	Yellowish	April-May
3 *Evonymus americanus*	Strawberry bush	4-6′	Greenish	June
3 *Ilex glabra*	Inkberry	2-4′	Inconspicuous	June-July
3 *Ribes floridum*	Wild black currant	2-4′	Greenish white	April-May
PLANTS GROWING IN DRY, SUNNY SITUATIONS				
3-6 *Corylus americana*	Hazelnut	3-8′	Inconspicuous	March-April
3-6 *Corylus rostrata*	Beaked hazelnut	3-8′	Inconspicuous	April-May

*Key to soil conditions:

Two or more numbers indicate a combination of soil conditions; for example 2-4 is loam with a clay subsoil.

1. Clay.
2. Clay subsoil.
3. Clay loam.
4. Loam.
5. Leafmold.
6. Gravelly soil.
7. Sandy loam.
8. Disintegrated limestone.
9. Disintegrated flint.

	Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom
3-8	*Ostrya virginiana*	Hop hornbeam	20-30′	Inconspicuous	April-May
8	*Rhamnus caroliniana*	Carolina buckthorn	20-30′	Greenish	May-June
3	*Rhus copallina*	Dwarf sumac	10-20′	Greenish	June-Aug.
3	*Rhus glabra*	Smooth sumac	3-10′	Greenish	June-Aug.
3	*Rhus typhina*	Staghorn sumac	10-30′	Greenish	June
3	*Salix humilis*	Prairie willow	2-8′	Inconspicuous	April-May
9	*Salix tristis*	Dwarf gray willow	2-3′	Inconspicuous	March-April
3	*Symphoricarpos occidentalis*	Wolfberry	1-3′	Greenish white	June-July
3	*Symphoricarpos racemosus*	Snowberry	1-4′	Pinkish white	June

PLANTS GROWING IN DRY, SHADY SITUATIONS

3	*Evonymus obovatus*	Running strawberry bush (Trailing)	1′	Greenish	April-May
3	*Myrica peregrina*	Sweet fern	2-4′	Inconspicuous	April-May
3	*Rhamnus Frangula*	Alder buckthorn	4-6′	Greenish	May-June
3-8	*Ribes Cynosbati*	Prickly gooseberry	2-4′	Greenish	April-June
3	*Ribes gracile*	Missouri gooseberry	2-4′	White or greenish	May
3	*Symphoricarpos vulgaris*	Coral-berry	2-4′	Pinkish white	June-July

IX. NATIVE TREES AND SHRUBS WITH BRIGHT COLORED FOLIAGE IN AUTUMN AND CONSPICUOUS FRUIT AND BARK IN AUTUMN AND WINTER

The gorgeous colors of autumn foliage may be introduced in our gardens and pleasing and harmonious color combinations obtained by the selection of some of the native plants given in this list. The subject is somewhat complex due to the fact that trees and shrubs of the same species do not always assume the same color at the same time in autumn. Some trees or parts of trees are more brilliant than others. Different leaves or branches or different parts of the same leaves of some plants will often show different colors. In the smoky atmosphere of cities the trees and shrubs do not assume such brilliant colors as where the air is pure.

Our gardens might also be made more attractive and interesting in autumn and winter by planting trees and shrubs having bright-colored bark or showy fruit. Incidentally the fruit will serve as food for birds whose winter work of exterminating hibernating insects is of the utmost importance to the welfare of our plantations.

Botanical name	Common name	Color of leaves	Color of fruit	Color of bark
		TREES		
Acer Drummondii	Drummond's maple	Yellow		
Acer nigrum	Black sugar maple	Bright yellow		
Acer rubrum	Red maple	Bright yellow		Twigs red
Acer saccharum	Sugar maple	Bright yellow		
Asimina triloba	Papaw	Yellow		
Betula lenta	Black birch	Yellow	Greenish	White
Betula lutea	Yellow birch	Yellow	Greenish	Yellowish
Betula nigra	River birch	Yellow	Greenish	Reddish
Betula papyrifera	Paper birch	Yellow	Greenish	White
Betula populifolia	American white birch	Yellow	Greenish	White
Bumelia lycioides	Southern buckthorn		Black	
Carya, all species	Hickory	Yellow		
Castanea dentata	American chestnut	Yellow		
Catalpa bignonioides	Indian bean		Green, turning brown	
Catalpa speciosa	Larger Indian bean		Green, turning brown	
Celtis mississippiensis	Southern hackberry		Reddish black	
Celtis occidentalis	Hackberry		Reddish black	
Cercis canadensis	Red-bud		Dark brown	Brownish black
Cladrastis tinctoria	Yellow-wood	Yellow		
Cornus florida	Flowering dogwood	Brilliant red	Red	
Crataegus cordata	Washington thorn	Reddish bronze	Scarlet	
Crataegus Crus-Galli	Cockspur thorn		Greenish red	
Crataegus macracantha	Long-spined thorn		Red	
Crataegus punctata	Hawthorn	Yellow	Red	
Diospyros virginiana	Persimmon	Yellow	Greenish yellow	
Fraxinus lanceolata	Green ash	Greenish blue	Greenish	
Gymnocladus canadensis	Kentucky coffee-tree		Brown	
Liquidambar Styraciflua	Sweet gum	Scarlet and yellow	Brownish	
Liriodendron tulipifera	Tulip tree	Yellow		
Magnolia acuminata	Cucumber tree		Orange-red	
Magnolia glauca	Sweet bay	Glossy green	Orange-red	
Magnolia tripetala	Umbrella tree	Bright green	Orange-red	
Nyssa sylvatica	Tupelo	Bright scarlet	Bluish black	

Botanical name	Common name	Color of leaves	Color of fruit	Color of bark
Oxydendron arboreum	Sorrel tree	Brilliant red		
Platanus occidentalis	Sycamore	Grayish green		White
Populus alba	Silver-leaved poplar	Yellow		Twigs silvery gray
Prunus americana	Wild red plum	Red		
Prunus pennsylvanica	Wild red cherry	Red		
Prunus serotina	Wild black cherry	Yellow	Black	
Pyrus angustifolia	Narrow-leaved crab-apple		Greenish yellow	
Pyrus coronaria	American crab-apple		Greenish yellow	
Pyrus ioensis	Western crab-apple		Greenish yellow	
Quercus coccinea	Scarlet oak	Reddish bronze		
Quercus imbricaria	Shingle oak	Glossy green		
Quercus palustris	Pin oak	Reddish bronze		
Quercus phellos	Willow oak	Glossy green		
Quercus rubra	Red oak	Brilliant red		
Quercus velutina	Quercitron	Reddish bronze		
Sapindus marginata	Soapberry	Yellow	Black	
Sassafras officinale	Sassafras	Scarlet and yellow		Green
Viburnum Lentago	Nannyberry	Red	Black	

SHRUBS

Aesculus arguta	Western buckeye	Yellow		
Aesculus Pavia	Red buckeye	Yellow		
Alnus incana	Speckled alder		Green turning black	
Amelanchier alnifolia	Service-berry	Red and yellow		
Amelanchier Botryapium	Shad-bush	Red and yellow		
Amorpha canescens	Lead plant		Grayish	
Baccharis halimifolia	Groundsel bush		White	
Benzoin aestivale	Spice bush	Bright red		
Berberis canadensis	American barberry	Scarlet and yellow	Red	
Bumelia lanuginosa	Woolly buckthorn		Black	
Cephalanthus occidentalis	Button-bush		Green turning brown	
Chionanthus virginica	Fringe-tree		Bluish black	

Botanical name	Common name	Color of leaves	Color of fruit	Color of bark
Cornus alternifolia	Alternate-leaved dogwood		Blue	Light green
Cornus Amomum	Silky cornel	Reddish	Blue	
Cornus Baileyi	Bailey's cornel	Reddish	White	Bright red
Cornus candidissima	Panicled dogwood	Reddish	White	
Cornus circinata	Round-leaved dogwood	Reddish	Light blue	
Cornus stolonifera	Red osier dogwood	Reddish	White	Red
Cornus stricta	Stiff cornel		Pale blue	
Dirca palustris	Leather-wood	Yellow		
Elaeagnus argentea	Silver-berry	Silvery gray	Silvery gray	Silvery gray
Evonymus americanus	Strawberry bush	Pinkish red	Orange and red	Green
Evonymus atropurpureus	Wahoo	Bright red	Orange and red	Green
Evonymus obovatus	Running strawberry bush		Orange and red	
Hamamelis virginiana	Witch-hazel	Yellow		
Ilex decidua	Swamp holly		Brilliant red	Gray
Ilex glabra	Inkberry		Black	
Ilex opaca	American holly	Evergreen, glossy	Bright red	
Ilex verticillata	Winterberry		Bright red	Gray
Itea virginica	Virginia willow	Brilliant red		
Lonicera caerulea	Blue honeysuckle	Yellow	Bluish black	
Lonicera ciliata	American fly honeysuckle	Yellow		
Myrica cerifera	Wax myrtle		White	
Ostrya virginiana	Hop hornbeam		Greenish yellow	
Prunus virginiana	Choke cherry	Yellow		
Pyrus arbutifolia	Chokeberry	Red	Bright red	
Pyrus nigra	Black chokeberry	Red	Black	
Physocarpus opulifolius	Nine-bark		Greenish red, turning brown	
Rhamnus caroliniana	Carolina buckthorn		Red, blue, black	
Rhamnus Frangula	Alder buckthorn		Red, blue, black	
Rhus canadensis	Fragrant sumac	Red		
Rhus copallina	Dwarf sumac	Dark red	Red	
Rhus glabra	Smooth sumac	Red	Red	

Botanical name	Common name	Color of leaves	Color of fruit	Color of bark
Rhus trilobata	Ill-scented sumac	Red		
Rhus typhina	Staghorn sumac	Light green and red		
Rosa, native species	Roses	Red or reddish	Red	
Sambucus canadensis	American elder	Yellow	Black	
Staphylea trifolia	Bladder nut		Light green	
Symphoricarpos occidentalis	Wolfberry		Greenish white	
Symphoricarpos racemosus	Snowberry		White	
Symphoricarpos vulgaris	Coral-berry		Red	
Vaccinium corymbosum	Tall blueberry	Red		
Vaccinium vacillans	Low blueberry	Red		
Viburnum cassinoides	Withe-rod	Reddish	Black	
Viburnum dentatum	Arrow-wood		Black	
Viburnum molle	Soft-leaved arrow-wood		Black	
Viburnum Opulus	High bush-cranberry	Bronze	Red	
Viburnum prunifolium	Black haw	Red	Black	
Viburnum rufidulum	Southern black haw	Red	Black	

X. NATIVE EVERGREEN TREES AND SHRUBS

The following native evergreen trees and shrubs cannot be grown successfully in the smoky atmosphere of manufacturing cities, but removed from these conditions they constitute a class of planting material which should be much more generally employed. Evergreens are particularly effective in contrasts with deciduous plants and in winter when other plants have shed their leaves. The larger-growing kinds form effective shelters and windbreaks, and the shrubby smaller forms are useful for foreground and foundation plantations. They are very effective as shelter and nesting plantations for our native birds.

	Botanical name	Common name	Height	Native habitat
*3	*Juniperus communis*	Juniper	10-25′	Dry hills
3	*Juniperus nana*	Low juniper	6-18′	Dry ground
3	*Juniperus Sabina*	Shrubby red cedar	2-4′	Banks and hillsides
3-8	*Juniperus virginiana*	Red cedar	50-100′	Dry rocky soil

Botanical name	Common name	Height	Native habitat
3-9 *Pinus echinata*	Yellow pine	50-100′	Rocky woods
3 *Pinus ponderosa*	Western yellow pine	100-150′	Woods
3 *Pinus resinosa*	Red pine	100-200′	Woods
3 *Pinus rigida*	Pitch pine	40-80′	Rocky woods
3 *Pinus Strobus*	White pine	50-100′	Woods
3 *Pinus virginiana*	Scrub pine	50-100′	Woods
3 *Taxus minor*	American yew	3-6′	Dry woods
3 *Thuja occidentalis*	Arbor-vitae	30-60′	Woods
3 *Tsuga canadensis*	Hemlock	50-100′	Woods

*Key to soil conditions same as in List VIII.

NOTES

Dr. W. H. Chambers, formerly Rufus J. Lackland Fellow, has accepted a position as Research Associate at the Barnard Free Skin and Cancer Hospital.

The women attending the conventions of the National Association of Druggists and of the American Society for Municipal Improvements visited the Garden recently.

Dr. George T. Moore, Director of the Garden, addressed the Patrons-Teachers' Association of the Sherman School, October 19, on "The Missouri Botanical Garden as a Neighborhood Institution."

Dr. George W. Freiberg, formerly Rufus J. Lackland Fellow, now Bacterial Research Chemist at the Commercial Solvents Corporation, Terre Haute, Indiana, spent a few days at the Garden recently, consulting the library.

Recent visitors to the Garden include Mr. Barnard, in charge of the research laboratories, American Bakers' Association, Minneapolis, October 6, and Mr. L. W. Durrell, of the Missouri Fruit Experiment Station, Mountain Grove, October 12.

The following lectures have been delivered during the month by Dr. Hermann von Schrenk, Pathologist to the Garden: October 12, before the Garden Club of St. Louis, "Pacific Coast Trees;" October 14, before the convention of the American Society for Municipal Improvements, "Recent Developments in Wood Block Paving;" and October 18, before the St. Louis Academy of Science, "The Forest Resources of the United States."

STATISTICAL INFORMATION FOR SEPTEMBER, 1920

GARDEN ATTENDANCE:

Total number of visitors.....19,170

PLANT ACCESSIONS:

Total number of plants and seeds received as gifts....	119
Total number of packets of seeds received in exchange	2
Total number of plants received in exchange.....	57

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought.....	36
Total number of books and pamphlets donated.....	332

HERBARIUM ACCESSIONS:

By Gift—

J. A. Drushel—Plants of Colorado and Texas.....	10
Dr. B. M. Duggar—Plants of California.....	2
Dr. J. M. Greenman—*Clitocybe ochropurpurea* from St. Louis County, Mo.....	1
E. D. Hallock—*Cantharellus minor* and *Lactarius fulginosus* from St. Louis.....	2
C. J. Humphrey—*Peniophora tabacina* from Wisconsin	1
Dr. A. L. Kammerer—*Ceanothus* sp. from Colorado....	1
F. P. McWhorter—Fungi from Tennessee and Chicago..	3
H. W. Peterson—*Monotropa uniflora* L. from Missouri..	1
Dr. H. von Schrenk—Plants of California.....	14
E. M. Wakefield—Fungi of England and Wales.....	24
Dr. S. M. Zeller—Fungi of Oregon.....	10

By Exchange—

Geo. L. Moxley—Plants of California.....	3
	72

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2:00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

STAFF
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Physiologist in charge of Graduate Laboratory.

HERMANN VON SCHRENK,
Pathologist.

EDWARD A. BURT,
Mycologist and Librarian.

JESSE M. GREENMAN,
Curator of Herbarium.

JOANNE L. KARBER,
Research Assistant.

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Secretary to the Director

NELL C. HORNER,
Editor of Publications.

G. H. PRING,
Horticulturist.

JOHN NOYES,
Landscape Designer.

L. P. JENSEN,
Arboriculturist.

PAUL A. KOHL,
Floriculturist.

P. C. BRAWNER,
Painter.

W. F. LANGAN,
Engineer.

H. VALLENTINE,
Construction.

MISSOURI BOTANICAL GARDEN BULLETIN

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SPECIMEN OF PANAMA-HAT PALM AT THE GARDEN.

FLOWER STALK OF PANAMA-HAT PALM.

Missouri Botanical Garden Bulletin

Vol. VIII St. Louis, Mo., November, 1920 No. 9

HATS FROM PLANTS

Of the many economic uses to which plants are put, one of the oldest is the manufacture of hats. The fibers obtained from the stem and leaves of many tropical and subtropical grasses and palms lend themselves admirably for this purpose, and primitive races long ago recognized the value of such material for the making of hats as well as other articles of clothing. Most of the plants which have been used for hat making are included in the Garden collection, and those in the following list marked with an asterisk may be found in either the economic garden or among the exotic plants in the Garden greenhouses.

GRASSES

The order Gramineae, noteworthy for its many edible products such as wheat, barley, rice, corn, sugar, etc., possesses many plants used in the manufacture of both hats and paper.

*The sugar cane *(Saccharum officinarum)* occurs both wild and cultivated throughout tropical and subtropical Asia. Its cultivation extended to Persia in the early Middle Ages and was carried by the Arabs into Sicily, Cyprus, Spain and Italy. The plant soon became widely known for its economic products and by the sixteenth century had been introduced into the New World. At the present time it is grown commercially in the West Indies, Mauritius, British Guiana, Cuba, Natal, Australia, Java, India, southern United States, and the Philippines. In Europe it is successfully cultivated only in Malaga, Spain. In Tahiti and the Islands of Samoa the long slender leaves are used in making hats similar in shape to the common stiff straw hats.

*The esparto grass *(Stipa tenacissima)* is a native of Spain, Italy and northern Africa. It was used by the Romans for cordage and is now employed in hat and paper making. In

Italy and Portugal hats from this material are made with an extremely large brim, the width of which equals the height of the crown.

*The dog's-tail grass *(Cynosurus cristatus)* is native of Europe and naturalized in North America. It is one of the short spike grasses incorporated in grass mixtures for lawns and pastures. Straw made from the stem and leaves has been braided and made into hats. In the earlier days hats of this type were made in Northumberland, England, being worn by the shepherds. The peasants of Wexford, Ireland, used this grass either dyed or plain for mat and basket making.

*Uva grass *(Gynerium saccharoides)* is a native of the tropics where it grows to a height of 40–80 feet. In Dominica and the Rio Casiquiare the natives make hats by braiding and sewing together the long thin split fibers of the leaves, these hats being remarkable for their lightness. The flower stalks have been employed by the Indians of the Rio Negro for making the shafts of poisoned arrows used for spearing fish.

The tribe Hordeae which includes wheat, barley, rye, etc., furnishes the straw for making American and European hats. *Triticum tenax* is used principally for hats worn by seamen. The straw is extremely tough and when covered with a water-resisting cloth makes a very durable head-covering. In China and Japan hats are made from the wheat straw, *Triticum vulgare*, the shape suggesting the steel helmets worn by the American and English soldiers during the late war. The prepared straw which is braided is exported in large quantities to this country and Europe where it is eventually made into hats. In Florence, Italy, *Triticum vulgare* var. *aestivum* is a favorite hat material. In Portugal the hat-making industry is given over to prisoners.

BAMBOO

*The giant bamboo *(Bambusa arundinacea)* is a native of India where it grows to a height of 60 feet. The canes or stems are split into long fibers and used by the natives in the manufacture of hats. The seed is eaten by the poorer classes as a substitute for rice or millet and is commonly called by them bamboo rice. The stems, which frequently measure 10 inches to one foot in diameter, are used as flower pots. For this purpose the elongated stems are cut below the nodes, the joint or node constituting the bottom of the pot. In Corea the canes are split as fine as thread and used by the High Mandarins for making sun blinds. In India the young succulent shoots are prepared into delicate pickle. Two large speci-

men bamboo plants towering to a height of 40 feet form an arch in the north end of the palm house at the entrance to the fern house, the oldest cane measuring four inches in diameter.

PALMS

*The date palm *(Phoenix dactylifera)* is widely spread over southern Europe, northern Africa, and southeastern Asia, where it grows to a height of from 40 to 80 feet. Apart from the value of the fruits and fiber as food, the leaves are used by the Bedouin women for making hats. The date palm is cultivated in Bordighera exclusively for the leaves which are used as a decoration in church festivals. For this purpose the young growths are blanched by being tied together in bundles.

*The Chinese fan palm *(Livistona chinensis)* is also used for decoration and may be seen in the Catholic churches on Palm Sunday. The large fan-shaped leaves with the divided ends are collected, the inner portion being made into fans and the remaining portion blanched and used in festivals. The Garden has frequently supplied young leaves of the fan palm for Jewish festivals in this city when other sources of supply have failed.

*Coir palm *(Trachycarpus excelsa)* is a native of China and Japan. The dense fibers surrounding the leaves, as well as the leaves themselves, are used by the Chinese and Japanese in making hats. In shape these are entirely different from those made of bamboo, having a short conical crown, with a tassel made from the trunk fibers, and a very short, turned-up brim.

*The Bermuda palm *(Sabal Blackburniana)* is a native of the West Indies where it is commonly called the giant fan palm. The leaves are stripped of the fibrous portion and made into hats by the natives. The leaves are also used as shingles on the native huts.

*The dwarf fan palm *(Chamaerops humilis)* is a native of southern Europe where it rarely reaches a height of 20 feet. In Sicily the leaves are finely split and made into hats. The finished product is a rather rough, dirty yellow straw and resembles in shape the old-fashioned shepherd's hat of England. In Arabia the fibers are split to a finer degree, the hat presenting a smoother finish and also a lighter color.

The double cocoanut palm *(Lodoicea sechellarum)* is a native of the Seychelles Islands where it attains a height of from 50 to 100 feet. Before the discovery of these islands the large twin nuts were occasionally found floating in the

Indian Ocean. In view of the mystery of their origin large sums were frequently paid to sailors bringing them back as curios. The leaves, which are semi-fan-shaped, are used by the natives for hat-making and are exported to Europe in large quantities for the same purpose.

The palmyra palm *(Borassus flabelliformis)* is a native of tropical Africa and widely cultivated in India. The young leaves are used as a vegetable in Africa and India, and in the latter country the young leaves, or the cuticle, are collected for making hats.

The raffia palm *(Raphia Ruffia)* is a valuable palm native of Madagascar and cultivated in various parts of the tropics for the fiber obtained from its leaves. This is obtained by removing the cuticle or the superficial layer. The fiber is exported in large quantities and used for various purposes, such as mats, baskets, tying garden plants, etc. The natives use the fibers from both the trunk and leaves for making hats.

*Silver thatch palm *(Thrinax argentea)* is a dwarf palm, native of the West Indies where it grows to a height of 20 feet. The leaves are fan-shaped, pure white on the under side. The plants are grown in Cuba for the fiber stripped from the leaves, this fiber being imported into the United States and England in large quantities for making hats. Young plants are grown by the florists as decorative house plants.

Unlike most palms, the malacca cane *(Calamus Scipionum)* is a climber, often having stems 400 feet long encircling trunks of trees. The stems, or so-called canes, are exported in large quantities from Siak. They are used for making walking sticks, umbrella staves and handles, and, to a great extent in Europe, for handles of chimney sweepers' brushes, etc. In Manila the split canes are made into the well-known Manila hats.

*The panama-hat palm *(Carludovica palmata)* is a stemless pseudo-palm indigenous to the shady deep forests of Ecuador, Peru, etc. It is the most important species economically of the Cyclanthaceae, as it furnishes the fiber for the well-known panama hats. For this important industry the leaves are gathered in the young state just before they assume a green color. They are cut into narrow strips and the stiff veins removed while still attached to the petiole or leaf-stalk. They are then bleached by immersion successively in boiling water, in water acidulated with lemon juice, and finally in pure cold water. After this preparation the straw is ready for being made into the well-known panama hats. Hats of superior quality are said to be plaited from a single leaf without a break.

NATIVE PLANTS SUITABLE FOR THE GARDENS OF MISSOURI AND ADJOINING STATES

XI. NATIVE TREES ARRANGED ACCORDING TO FORM OF OUTLINE

The following list is given as an aid to those who wish to arrange the trees in their plantations according to form of general outline. The letters preceding the names indicate the general effect of the tree with mature leaves, D meaning dark, M, medium, and L, light.

1. LARGE TREES OF SOMEWHAT FORMAL SHAPE

	Botanical name	Common name
	SPECIMEN TREES	
M	*Aesculus glabra*	Ohio buckeye
D	*Aesculus octandra*	Yellow buckeye
D	*Acer nigrum*	Black sugar maple
L	*Acer rubrum*	Red maple
D	*Acer saccharum*	Sugar maple
D	*Celtis mississippiensis*	Southern hackberry
L	*Fagus americana*	American beech
D	*Fraxinus nigra*	Black ash
D	*Fraxinus pennsylvanica*	Red ash
L	*Fraxinus quadrangulata*	Blue ash
D	*Fraxinus viridis*	Green ash
D	*Liquidambar Styraciflua*	Sweet gum
L	*Liriodendron Tulipifera*	Tulip tree
L	*Nyssa sylvatica*	Tupelo
D	*Quercus coccinea*	Scarlet oak
D	*Quercus imbricaria*	Shingle oak
	TREES FOR MASS PLANTING	
L	*Acer Drummondii*	Drummond's maple
L	*Carya alba*	Mocker nut
L	*Carya illinoensis*	Pecan
L	*Carya glabra*	Pignut
L	*Carya laciniosa*	Big shell-bark
L	*Carya ovata*	Shell-bark hickory
L	*Diospyros virginiana*	Persimmon
L	*Gleditsia aquatica*	Swamp locust
D	*Juglans cinerea*	Butternut
D	*Populus alba*	Silver poplar
M	*Quercus minor*	Post oak
D	*Quercus velutina*	Quercitron
L	*Robinia Pseudacacia*	Common locust
M	*Sassafras officinalis*	Sassafras
D	*Tilia heterophylla*	White basswood
D	*Tilia pubescens*	Southern basswood

2. SMALL TREES OF SOMEWHAT FORMAL SHAPE

	Botanical name	Common name
	SPECIMEN TREES	
L	*Carpinus caroliniana*	American hornbeam
D	*Cercis canadensis*	Redbud
D	*Crataegus cordata*	Washington thorn
L	*Crataegus macracantha*	Long-spined thorn
L	*Crataegus punctata*	Large-fruited thorn
D	*Oxydendron arborea*	Sorrel tree
D	*Planera aquatica*	Planer tree
D	*Prunus americana*	Wild red plum
	TREES FOR MASS PLANTING	
L	*Amelanchier canadensis*	Juneberry
D	*Asimina triloba*	Papaw
L	*Bumelia lycioides*	Southern buckthorn
L	*Cornus florida*	Flowering dogwood
D	*Crataegus Crus-galli*	Cockspur thorn
D	*Prunus pennsylvanica*	Wild red cherry
M	*Pyrus angustifolia*	Narrow-leaved crab-apple
M	*Pyrus coronaria*	American crab-apple
M	*Pyrus ioensis*	Western crab-apple
L	*Rhus cotinoides*	American smoke-tree
M	*Robinia viscosa*	Clammy locust
D	*Viburnum Lentago*	Nanny-berry

3. LARGE GRACEFUL TREES

	Botanical name	Common name
	TREES FOR MASS PLANTING	
D	*Betula lenta*	Black sweet birch
L	*Betula lutea*	Yellow birch
M	*Betula nigra*	River birch
L	*Betula papyrifera*	Paper birch
M	*Betula populifolia*	American white birch
D	*Prunus serotina*	Wild black cherry
M	*Salix nigra*	Black willow
D	*Ulmus alata*	Winged elm
D	*Ulmus americana*	White elm
D	*Ulmus fulva*	Slippery elm
D	*Ulmus racemosa*	Cork elm

4. LARGE, SPREADING, PICTURESQUE TREES

	Botanical name	Common name
	SPECIMEN TREES	
M	*Castanea dentata*	American chestnut
L	*Cladrastis tinctoria*	Yellow-wood

	Common name	Botanical name
L	*Platanus occidentalis*	Sycamore
L	*Quercus acuminata*	Chinquapin oak
L	*Quercus alba*	White oak
L	*Quercus macrocarpa*	Bur oak
L	*Quercus platanoides*	Swamp white oak

TREES FOR MASS PLANTING

L	*Acer Negundo*	Box elder
L	*Catalpa bignonioides*	Indian bean
L	*Catalpa speciosa*	Large Indian bean
D	*Celtis occidentalis*	Hackberry
D	*Gleditsia triacanthos*	Honey locust
D	*Gymnocladus canadensis*	Kentucky coffee tree
M	*Juglans nigra*	Black walnut
L	*Populus deltoides*	Cottonwood
L	*Populus tremuloides*	American aspen
D	*Quercus palustris*	Pin oak
D	*Quercus Phellos*	Willow oak
M	*Tilia americana*	American linden

5. SMALL, SPREADING, PICTURESQUE TREES

	Botanical name	Common name
L	*Crataegus coccinea*	Red haw
L	*Crataegus mollis*	Red-fruited thorn
L	*Halesia tetraptera*	Silver bell
L	*Magnolia glauca*	Sweet bay
L	*Morus rubra*	Red mulberry
D	*Sapindus marginatus*	Soapberry

6. LARGE, CONICAL TREES

	Botanical name	Common name
M	*Taxodium distichum*	Bald cypress
M	*Magnolia acuminata*	Cucumber tree
M	*Magnolia tripetala*	Umbrella tree

XII. TREES FOR STREET AND AVENUE PLANTING

Botanical name	Common name
STREET TREES FOR SMOKY CITY CONDITIONS	
Acer saccharinum	Soft or silver maple
Fraxinus americana	White ash
Fraxinus viridis	Green ash
Gleditsia triacanthos	Honey locust
Platanus occidentalis	Sycamore
Populus deltoides	Cottonwood

Common name	Botanical name
STREET AND AVENUE TREES FOR SECTIONS NOT AFFECTED BY SMOKE	
The above and	
	Acer rubrum.....Red maple
	Catalpa speciosa.....Large Indian bean
	Celtis occidentalis.....Hackberry
	Liquidambar Styraciflua.....Sweet gum
	Liriodendron tulipifera.....Tulip tree
	Prunus serotina.....Wild black cherry
	Quercus alba.....White oak
	Quercus coccinea.....Scarlet oak
	Quercus imbricaria.....Shingle oak
	Quercus palustris.....Pin oak
	Quercus rubra.....Red oak
	Tilia americana.....American linden
	Ulmus americana.....White elm

NOTES

Dr. C. A. Weatherby, of Hartford, Connecticut, spent a day in the herbarium recently.

Dr. B. M. Duggar, Physiologist to the Garden, spoke before the Town and Gown, October 15, on "The Japanese Problem in California," and before the St. Louis Florists' Club, November 3, on "Mushrooms, Native and Cultivated."

Dr. Hermann von Schrenk, Pathologist to the Garden, addressed the American section of the Society Chemical Industry, at the Chemists' Club, New York, November 12, on "The Preservative Treatment of Wood, Its Broader Aspects and Some of Its Technical Phases."

Recent visitors to the Garden include Dr. Keita Shibata, Professor of Botany, Tokyo Imperial University, Tokyo, Japan, October 26; Mr. David G. Fairchild, Agricultural Explorer in charge of Foreign Seed and Plant Introduction, Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C., November 13; Dr. Bohumel Shimek, of Iowa State University, Iowa City, Iowa, November 11-13.

STATISTICAL INFORMATION FOR OCTOBER, 1920

GARDEN ATTENDANCE:

Total number of visitors.....19,658

PLANT ACCESSIONS:

Total number of plants received as gifts..... 4
Total number of plants received in exchange..... 28

PLANT DISTRIBUTION:

Plants distributed in exchange..... 5

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought..... 44
Total number of books and pamphlets donated..... 186

HERBARIUM ACCESSIONS:

By Purchase—

Miss Marie Gocker—Plants of Cameroun, West Africa.. 63

By Gift—

W. K. Bixby—*Rhytisma acerinum* from Lake George, N. Y. 1
T. S. Brandegee—Plants of Mexico..... 2
Bureau of Plant Industry, Washington, D. C.—Duplicates of fungi from the Langlois Herbarium..... 53
Carlos E. Chardon—Fungi of Ithaca, N. Y., and Porto Rico 10
Mrs. Sarah Cotton—Cultivated specimen of *Paulownia tomentosa* Steudl 1
Mrs. Dickerson—*Martynia luisiana* Mill..... 1
J. A. Drushel—Plants of the United States..... 27
F. P. McWhorter—Fungi from various localities..... 4
Prof. L. H. Pammel—Cultivated specimen of *Ampelopsis dissecta* Carr. from Burlington, Iowa..... 1
Charles E. Prunty—*Abutilon Theophrasti* Medic. from Missouri 1
Dr. H. von Schrenk—*Lentinus lepideus* from Montana.. 1
J. N. Watson—*Pholiota destruens* from St. Louis, Mo.... 1
J. R. Winston—*Corticium*, parasitic on *Citrus*..... 1

By Exchange—

New York Botanical Garden—Specimens of the Boraginaceae, collected by Dr. F. W. Pennell in Colombia and in eastern United States..... 58

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MISSOURI BOTANICAL GARDEN BULLETIN

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ST. LOUIS, MO.
1920

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OF THE MISSOURI BOTANICAL GARDEN

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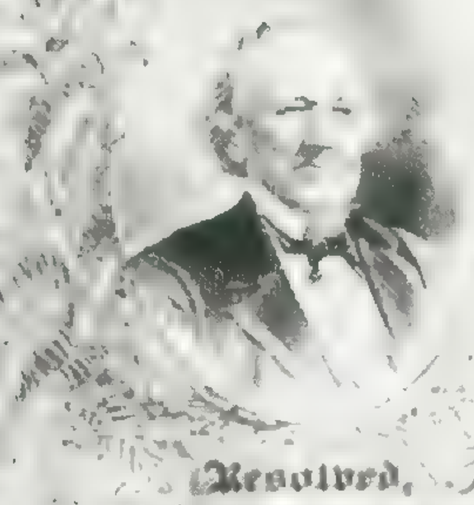
TESTIMONIAL

OF RESPECT AND GRATITUDE.

BY THE

MERCHANTS EXCHANGE OF ST. LOUIS.

December 1878



The MEMBERS OF THE MERCHANTS EXCHANGE of St. Louis, [illegible] by MR HENRY SHAW, trial classes of the City of St. Louis, realizing the great and lasting [illegible] deem it a duty to express in a formal and public manner their appreciation [illegible] and end in worthy, well-applied in the HALL OF THE EXCHANGE, December 19th, 1878, do order and adopt the following resolutions.

Resolved, That in the creation of TOWER GROVE PARK, by the donation to the CITY of the valuable lands composing it, in the recent gift of the magnificent bronze statues of SHAKESPEARE and HUMBOLDT, with their pedestals and relievos for the adornment of same, and in the establishment of the MISSOURI BOTANICAL GARDENS with their MUSEUM, CONSERVATORIES and the most remarkable collection in this country of the flora of all climes, MR. SHAW has materially aided the reputation and growth of ST LOUIS, and at the same time created delightful and permanent pleasure-resorts for our citizens in which the influence of nature and art is combined for the advancement of that general taste and culture without which there is no genuine civilization.

Resolved, That in the devotion of a private fortune acquired during an honorable business career in this CITY to the benefit of the public and the admirable mode selected to carry out his benevolent designs by which the pleasure and profit of all citizens are permanently secured together with the adornment of the CITY and the creation of those features of local interest which are always important elements in civic progress, MR. SHAW has made himself the BENEFACTOR of our PEOPLE reflected honor on the city of his home, endeared his name to its present and future population and is entitled to the earnest gratitude of all classes of society

Resolved, That as merchants and business men of the CITY OF ST LOUIS, it is especially incumbent upon us, and we esteem it a most pleasant duty to acknowledge the benefits bestowed upon the CITY and its citizens by one so long and intimately identified with the mercantile interests of the CITY Although now retired from active business, he worthily represents the spirit and liberality which should characterize the merchants of a metropolis representative of western civilization and throughout a useful and industrious career has evinced an earnest interest in the growth of the CITY which he has greatly aided It is peculiarly gratifying to the members of this EXCHANGE that a citizen who is among the oldest of our merchants should have achieved the [illegible] distinction of BENEFITTING ALL CLASSES OF THE PEOPLE and furnishing an impressive example of individual honor and rectitude linked with the most exalted and philanthropic purposes

Resolved, That the members of the MERCHANTS EXCHANGE in view of the facts herein stated and in accordance with the universal sentiment of the people of ST. LOUIS, hereby tender to HENRY SHAW their deep and heartfelt acknowledgement and thanks for his public spirit and noble generosity No other return than words of gratitude and respect is now appropriate or possible, but their significance is not limited to the present time so long as his gifts to the CITY endure and there are people to enjoy them, his name will be cherished in the public heart and his memory will bloom in the beauties of the park and gardens which he created for the enjoyment of all.

ORDERED, That these resolutions be spread upon the records of this body, and that when suitably engrossed, a committee consisting of the President and Directors of the Exchange and twenty citizens, to be designated by the President shall formally present them to MR SHAW.

REPRODUCTION OF TESTIMONIAL TO HENRY SHAW BY THE MERCHANTS EXCHANGE OF ST. LOUIS.

Missouri Botanical Garden Bulletin

Vol. VIII St. Louis, Mo., December, 1920 No. 10

AN EARLY APPRECIATION OF HENRY SHAW BY THE ST. LOUIS CHAMBER OF COMMERCE

The following quotation from the Fourth Annual Report of the St. Louis Chamber of Commerce, for the year 1859, is of considerable interest from an historical standpoint, since it shows how definitely, even at this early date, Mr. Shaw had formulated the scope and activities of the Missouri Botanical Garden. Twenty years later, the Merchants Exchange of St. Louis, in a meeting assembled in the hall of the Exchange, adopted a set of resolutions in which they attempted to express their respect and gratitude to Mr. Shaw for his donation of Tower Grove Park, with its bronze statues, as well as for the establishment of the Missouri Botanical Garden. This testimonial, originally printed on satin, is reproduced on the opposite page (plate 15).

"As Economic Botany cannot but be peculiarly interesting to the people of this city and state, whose commerce is composed, to a great extent, of vegetable productions, it will be considered appropriate to refer in this report to a munificent bestowment to the city by MR. HENRY SHAW of a Botanic Garden, with all the appliances and endowments requisite to render such an enterprise efficient and permanent—the equal if not the superior of any similar establishment in the United States. The land which he intends to donate for the purpose lies only three and a half miles from the Court House, and comprises six hundred acres. At one point fifteen acres front on Grand Avenue, the boundary line of the city on the west, from which fact some idea may be formed of the value of the tract. The total of the gift may be safely estimated at one million dollars. For several years past the work has been steadily progressing, and at this time shows such a near finish, as fully to develop the liberal and enlightened design of the donor. The work of the year just closed was the erection of a Museum and Library, of fine architectural design and workmanship, at a cost of $20,000. The garden proper, with an

area of ten acres (which is ample for the purposes intended) is surrounded by a wall of the best masonry, the main entrance to which is by a gate of beautiful design and massive construction. The whole of this area is thoroughly underdrained at a heavy expense. Leading from the gate through the lands of the donation, will be a broad avenue (already designated as Floral Avenue) one mile in extent and sixty feet in width, lined on either side with ornamental trees, which will prove, no doubt, one of the most attractive thoroughfares in or near the city. The gateway includes rooms for the keeper, and retiring rooms for visitors. The conservatory in the garden is already finished, and combines all requisite advantages, such only as a cultivated judgment and taste, assisted by rare opportunities of observation in other countries, could have planned or suggested.

"During the present year it is the intention of Mr. Shaw to erect a row of plant houses near the middle of the garden, which will constitute an additional feature of great beauty. The central one of these will be eighty by forty feet in dimensions, to be termed the Pavilion, constructed of glass and iron columns upon stone arches, after a good style. Adjoining the garden on the north, and connected with it by two arched openings, is the Fruticetum. Six acres, well enclosed and trenched, are dedicated to the improvement and propagation of such fruits as best suit the climate of Missouri. West of the Garden the Arboretum is located, containing twenty-five acres, and here the stately and beautiful trees of our own forests, as well as those of other lands adapted to the climate, are intended to find a place. Already several fine specimens from California, Europe, Asia, and Africa have been planted, and are flourishing finely. The walks throughout are laid of the best material for the purpose. The present elegant residence, known as Tower Grove, will be reserved for the Curator, and for the meetings of the Trustees, to whom the entire charge of the Garden will be ultimately entrusted. The Curator will be a man of highly scientific and practical ability, thoroughly versed in all that pertains to the science and art of Botany and Horticulture.

"Fifty acres, it will be observed, are thus occupied. The great body of the land, comprising some 500 acres, will be leased in small tracts, the rents from which will afford a large revenue for the support of the institution. Lying contiguous to the city, this land will be eagerly sought for gardening purposes, and furnished with comfortable and tasty cottages (ten of which have already been erected), we presume the

AMERICAN HOLLY TREE AT THE GARDEN.

VIEW OF 1920 CHRYSANTHEMUM SHOW FROM BALCONY OF FLORAL DISPLAY HOUSE.

rents will prove amply sufficient for the object, even on the liberal scale projected. The monuments of the liberality of individual citizens are numerous in our midst—they are dedicated to moral, educational, benevolent, and artistic purposes, and not only beautify, enrich, and ennoble the city, but exhibit an attachment to her interests and a pride in her prosperity that insure the fulfillment of the great destiny to which her past and present progress points."

THE AMERICAN HOLLY FOR ST. LOUIS

Of the many evergreens that dominated the Garden flora of former days, the holly is the only representative genus that has withstood the smoky atmosphere of St. Louis. The main garden still retains the original groups and individual specimens planted by Mr. Shaw, and while the foliage and berries are darker than plants grown in the country, due to discoloration by smoke, the trees are in a remarkably healthy condition. For a city evergreen the holly is therefore recommended above all other evergreens on account of its smoke-resisting quality (see plate 16, also plate 1 in January, 1920, BULLETIN).

The American holly, *Ilex opaca*, is a slow-growing plant found in varied kinds of soil. In the Northern and Southern states the largest specimens are found in poor, sandy loam. In the woods of Massachusetts they are abundant on southern slopes densely covered with deciduous trees, the low branches of which protect the hollies from exposure. In the South the plants are stronger and mature into specimen trees much quicker than in the North, and it is from this source that the Christmas supply of holly is generally obtained.

When selecting hollies for planting in the garden the fact should be borne in mind that they are generally dioecious in habit, that is, the sexes are on separate trees. It is therefore necessary that the male and female trees be planted close together to allow pollination by action of either wind or insects, otherwise there will be an absence of the ornamental berries. As hollies are slow-growing trees, large specimens should be obtained if immediate effect is desired. These subject themselves readily to transplanting providing a few precautions are followed. The best time to remove them is in the fall just before the ripening of the wood, or in the spring just before the appearance of the new wood, the latter perhaps being the best owing to the lateness of our falls. The essential factor at the time of transplanting is the defoliation, and fully two-thirds of the leaves should be removed to reduce

transpiration. The many fibrous roots will allow a large ball to be dug commensurate to the size of the plant removed (see December, 1917, number of the BULLETIN).

The English and the American holly are very similar. Both have spiny leaves, but the English holly, *Ilex aquifolium*, has deeper spaces between the spines and is a denser-leaved specimen. Prior to the government restriction of importing plants with soil attached, the English variety was imported by the thousands in the form of potted plants and sold by the florists during the Christmas season.

No other plant, except the mistletoe, is so much associated with Christmas as the holly. The Druids gave the holly a place of honor in their Yuletide ceremonies, but even antedating the Christmas day of England the holly was used in festivities to denote the turning of the sun. The bright red berries make their appearance in September and often persist until March or April. The brilliant fruit in contrast with the dark green foliage makes the plant an effective floral decoration.

CHRYSANTHEMUM SHOW FOR 1920

Due to the favorable weather for keeping flowers the annual chrysanthemum show was maintained for six weeks in 1920. The exhibition included two thousand bush plants in variety of color and size ranging from the original single-flowered yellow *C. indicum* to the large double-flowered white "Josephine Foley." The single-stemmed types terminating in mop-like blooms measuring 10-12 inches in diameter numbered over 1800 plants. The "Turner" type, a light yellow variety, dominated the show by being concentrated in a single central bed. On account of their incurved petals and their cream color they were much admired, especially by the feminine visitors who referred to them as "cream puff" chrysanthemums. In contrast to this type was the tiny yellow pompon called "Baby," with flowers half an inch in diameter.

Among the novelties was a collection of Japanese freak chrysanthemums shown for the first time in St. Louis. The most striking of these was "Tachibana," a large spider-like flower with yellow thread, or filiform, pendant petals. A large grafted plant was exhibited showing twelve distinct varieties of flowers upon a single plant. For this experiment the shoots were detached in the early stage, about June, and then grafted upon the parent plant. Another new feature of the 1920 show was the introduction of hanging baskets. These specimens were suspended from the roof overhanging

JAPANESE ODDITIES AT CHRYSANTHEMUM SHOW

SUNDAY CROWD AT CHRYSANTHEMUM SHOW.

the walks and added a finish to the display which it has not heretofore been possible to obtain. For this manner of cultivation the varieties with pendant growth were selected, those best adapted being "Anna," a single white, "Cosmos," single pink, and a single yellow somewhat suggesting *C. indicum.* The plants were grown in the baskets from the cutting, or early rooting, stage, in April, to the flowering period.

The largest November attendance, excluding the World's Fair period, was recorded while this show was on, the total for the month being over 93,000. The maximum Sunday attendance was recorded on November 21, when 18,000 people passed through the floral display house between 1 and 5 P. M. The line of visitors was continuous from the flower house to the east end of the rose garden.

The show was discontinued November 30, and the flowers were distributed to the hospitals through the Book and Flower Guild. The total number of flowers given away amounted to over 40,000. Over twenty-five local hospitals received flowers, the City Hospital receiving the maximum of 7,000.

NATIVE PLANTS SUITABLE FOR THE GARDENS OF MISSOURI AND ADJOINING STATES

XIII. NATIVE TREES AND SHRUBS FOR UNFAVORABLE AND SMOKY CITY CONDITIONS

The smoky atmosphere of manufacturing cities, such as St. Louis, is very injurious to trees and shrubs. Many species will not stand these conditions at all, particularly the conifers and other evergreen plants which do not discard their leaves annually.

Among the conifers the pines will survive longer than others, and among the broad-leaved evergreen trees, the holly, *Ilex opaca,* will grow quite well in moderately smoky conditions. Conifers are, however, not recommended to be planted extensively in manufacturing cities where bituminous coal is used as fuel. Fortunately some deciduous trees and shrubs will thrive in a smoky atmosphere, as indicated by the following list of native material:

TREES

Botanical name	Common name
1. POOR SOIL AND VERY SMOKY ATMOSPHERE	
Maclura pomifera	Osage orange
Morus rubra	Red mulberry
Platanus occidentalis	Buttonwood
Populus deltoides	Cottonwood
Robinia Pseudacacia	Black locust

Botanical name	Common name
2. MEDIUM CONDITIONS	
Acer saccharinum	Soft or sugar maple
Catalpa bignonioides	Indian bean
Catalpa speciosa	Western catalpa
Fraxinus americana	American or white ash
Gleditsia triacanthos	Honey locust
Gymnocladus canadensis	Kentucky coffee tree
Liquidambar Styraciflua	Sweet gum
Liriodendron Tulipifera	Tulip tree
Populus tremuloides	American aspen
Salix species	Willows
Ulmus americana	American elm
Ulmus fulva	Slippery elm
Ulmus alata	Winged elm
3. MOST FAVORABLE CONDITIONS OF SMOKY CITY	
Acer saccharum	Sugar maple
Betula papyrifera	American white birch
Betula nigra	River birch
Celtis occidentalis	Hackberry
Cercis canadensis	Red-bud
Chionanthus virginica	White fringe tree
Cornus florida	Flowering dogwood
Magnolia acuminata	Cucumber tree
Magnolia glauca	Sweet bay
Magnolia tripetala	Umbrella tree
Pyrus americana	American crab-apple
Pyrus ioensis	Western crab-apple
Quercus alba	White oak
Quercus macrocarpa	Bur oak
Quercus palustris	Pin oak
Quercus rubra	Red oak
Tilia americana	Basswood

SHRUBS

Botanical name	Common name
1. VERY SMOKY CONDITIONS	
Amorpha fruticosa	False indigo
Aralia spinosa	Hercules' club
Cornus stolonifera	Red Osier dogwood
Lycium vulgare	Matrimony vine
Philadelphus coronarius	Mock orange
Philadelphus grandiflorus	Large-flowering mock orange
Philadelphus inodorus	Scentless mock orange
Physocarpus opulifolius	Ninebark
Rhus glabra	Smooth sumac
Sambucus canadensis	Elder
Viburnum Opulus	High-bush cranberry

Botanical name	Common name
2. LESS SMOKY CITY CONDITIONS	
Baccharis halimifolia	Groundsel bush
Calycanthus floridus	Strawberry bush
Cephalanthus occidentalis	Button-bush
Cornus alternifolia	Alternate-leaved dogwood
Cornus Amomum	Silky cornel
Cornus paniculata	Gray cornel
Halesia tetraptera	Silver-bell
Rhus copallina	Dwarf sumac
Rhus typhina	Staghorn sumac
Robinia hispida	Rose acacia
Rosa setigera	Prairie rose
Spiraea salicifolia var. ***alba***	Willow-leaved spiraea
Spiraea Douglasii	Douglas' spiraea

XIV. NATIVE PLANTS FOR GROUND COVERS

Low, compact plants which will spread sufficiently to cover the ground are often useful in the planting of gardens. This class of planting material is extensively used in the Eastern states to cover embankments, terraces, bare edges of shrubbery plantations, thereby connecting them with the lawn, and under deep-rooting trees in place of grass. The species adapted for this purpose, when we exclude exotic materials, are not numerous but sufficient for a variety of uses. Two species, *Lysimachia Nummularia* and *Vinca minor*, are not native but are so generally found escaped from cultivation that they may almost be regarded as indigenous. Clay loam is the preferred soil condition for plants of this type.

Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom	Remarks
Achillea Millefolium	Yarrow	1-3′	White	June-Oct.	If closely cut forms dense mat.
Achillea Millefolium rubrum	Yarrow	1-3′	Red	June-Oct.	If closely cut forms dense mat.
Achillea Millefolium roseum	Yarrow	1-3′	Purple	June-Oct.	If closely cut forms dense mat.
Convallaria majalis	Lily-of-the-valley	6-8″	White	April-May	Foliage dies early.
Lysimachia Nummularia	Moneywort	2-4″	Yellow	June-Aug.	Much used on terraces.
Malva rotundifolia	Dwarf mallow	6-8″	Blue	May	
Potentilla canadensis	Five-finger		Yellow	April-Aug.	Prostrate, long runners.
Sedum pulchellum	Widow's cross	6-12″	Rose-purple	May-July	
Vinca minor	Periwinkle	4-6″	Blue	April-May	Used for grave covers.

Botanical name	Common name	Approx. height	Color of flowers	Approx. time of bloom	Remarks
Viola striata	Violet	6-12"	White	April-May	Prefers a moist situation.
Waldsteinia fragarioides	Barren strawberry	Creeping	Yellow	May	Prefers dry shaded situations.

This concludes the series on "Native Plants Suitable for Missouri and Adjoining States." A series on "Hardy Exotic Plants for Missouri and Adjoining States," is in preparation for the 1921 issues of the BULLETIN.

NOTES

Mr. G. H. Pring, Horticulturist to the Garden, has been elected president of the St. Louis Association of Gardeners.

No. 2-3 of Vol. VII of the Annals of the Missouri Botanical Garden containing the twelfth installment of the monograph on "The Thelephoraceae of North America," by Dr. E. A. Burt, has recently been issued.

The October issue of Parks and Recreation contains two articles by Mr. L. P. Jensen, Arboriculturist to the Garden, one entitled "Public Parks as Bird Protectorates," and the other "The Influence of Parks on Civilization and Conservation of Plant Life."

Dr. George T. Moore, Director of the Garden, spoke before Town and Gown, December 17, on "Some Old Herbals and the Doctrine of Signatures." Some of the rare volumes of herbals in the Garden's unique collection were shown in connection with the lecture.

Dr. B. M. Duggar, Physiologist to the Garden, gave an illustrated lecture before the St. Louis Natural History Museum Association at the Central Public Library, December 15, on "Native Mushrooms and Their Habitat," and on December 16, he spoke before the St. Louis Garden Club on "The History of a Mushroom Bed and Mushroom Production."

STATISTICAL INFORMATION FOR NOVEMBER, 1920

GARDEN ATTENDANCE:
Total number of visitors.....93,389

PLANT ACCESSIONS:
Total number of plants and seeds received as gifts..... 5,137

PLANT DISTRIBUTION:
Plants distributed in exchange..... 10

LIBRARY ACCESSIONS:
Total number of books and pamphlets bought..... 29
Total number of books and pamphlets donated..... 174

HERBARIUM ACCESSIONS:

By Purchase—
Willard N. Clute—Plants of the Painted Desert, Arizona 108
W. S. Hammond—Private herbarium of the late E. W. Hammond, plants of Oregon, estimated at 700 specimens 700

By Gift—
Ira W. Clokey—Specimens of *Senecio* from Colorado.... 2
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The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2:00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

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